THE INFLUENCE OF NANOMAGNETIC PARTICLES ON *Trichogramma sp* SEX RATIO AND PROLIFICACY

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Abstract. *Trichogramma* is one of the most significant egg parasitoid in the biological and unpolluted pest control.

Key words: *Trichogramma* sp; Nano Magnetic Particles (NMPs), Sex Ratio, Prolificity;

Introduction

The extension of pest biological control represents one of the perspective trends in plant protection. Different species of *Trichogramma* are released to control more than 25 different caterpillar pests attacking corn, vegetables, sugar beets, fruit and forest trees, spruce and rice, sugarcane, cotton, pine tree (in Romania as well as all over the world respectively; Ryvkin, 1959). *Trichogramma* wasps occur naturally in almost every terrestrial and some aquatic habitats (Kehail et al., 2007). Their distribution is done according to the cultivated area, crops, pest attack and species. In some Europe Countries (France, Germany, Republic of Moldavia and Switzerland) an important corn areas were treated with *Trichogramma* against European corn borer (Hassan, 1994). In Romania research programs (BIOTECH and PNII) were initiated which led to developing models that can improve the wasp biological parameters for field delivery.

To increase the biological efficiency of the parasite different measures can be used (Consoli & Parra, 1997). Among them we introduced Magnetic Fluids (MFs), mixtures of Nano-Magnetic Particles (NMPs) as active part. The use of NMFs was desired as an alternative method to increase wasp's biological parameters with a low production costs.

Magnetic Fluids are any kind of fluid with magnetic properties, representing an appart material, pointing out and inducing new phenomena. Ferro Fluids / Magnetic Fluids or Nano Magnetic Fluids are ultrastable colloids of magnetic nanoparticles in water and organic carriers (O'Connor, 1962; Papell, 1965). Electrical conductivity ($\sigma = 0$) and magnetic permeability ($\mu \geq \mu 0$) are important parameters on hydrodynamics of ferrofluids (magnetic fluids) under the action of an applied magnetic field (Neuringer&Rosensweig 1964).

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Introduction of new methods and technologies, as nanotechnologies, represents a great perspective with practical implications in many domains of biological sciences.

At list two species of *Trichogramma* have been selected for experimental purposes *T. evanescens* ssp corn (strain TMZ02) and cabbage (strain TMBOC02) and *T. embryophagum*.

The main aim of this study was:

- to establish the Sex Ratio modification in specific conditions, different types of MFs and NMPs concentration;
- to point out the MF/NMPs in order to increase the *Trichogramma* prolificacy.

Materials and Methods

Trichogramma (Westwood) stocks and culture: *Trichogramma evanescens* (T. ev.) and *Trichogramma embryophagum* (T. embr.) species collected in Timişoara were used. The collected wasps are considerate as "landraces" because their evolution took place in this area. Two forms of *Trichogramma evanescens* were followed. To control *Ostrinia nubilaris* Hbn. and *Mamestra brassicae* L. *Trichogramma evanescens* – corn (strain TmZ02) and *Trichogramma evanescens* - cabbage (strain TmC02) respectively were used. *T. embryophagum* population composed of females only was a subject to evaluate NMPs effect. In laboratory condition both entomophagous species were allowed to develop on the host eggs of *Sitotriga cerealella* Oliv.

Magnetic nanofluids (MNFs) used in experiments have been prepared at the *Center for Technical Fundamental and Advance Research, Romanian Academy, Timişoara subdivision* (Dr. Chim. Doina Bica), characterized at the *National Center for Complex Fluids Systems Engineering „Polytechnica" University* Timişoara (Dr. Fiz. Ladislau Vekas), since 1987, were used in biological fields at the USAMVB Timişoara.

To improve the wasp prolificacy two types of MFs *with different NMPs* were used: γ-Fe_3O_4 and $CoFe_2O_4$ ($\theta = 0.45x10^{-5}$ and $\theta = 0.87x10^{-5}$ g Fe/cm^3 concentrations respectively). Prior to be parasitized by *Trichogramma* wasp the host eggs were pretreated with MFs (30µl/l). The *Trichogramma* female finds a *Sitotroga* egg, drills a hole through the chorion (egg shell) and inserts one or two eggs into the host. The internal pressure provides a drop of yolk, the necessary feed for the female. After 8-9 days a new adult wasps emerge. The new *Trichogramma* generation was considered as being FM wasps. Our observations on FM wasps were made.

The experimental data were statistically analysed, using plifactorial analysis (Ceapoiu, 1968)

Results and Disscution

In 1998 local landraces of *Trichogramma* were collected in Timişoara natural areas vegetable garden, fruit trees and parks. *Trichogramma* found favorable conditions around *Albizzia julibrissin* (Willd) trees to enhance their populations.

1. The Sex Ratio modification in FM populations. The sex ratio in different population of *Trichogramma* was less studied previously. A high proportion of females provide a larger number of butterflies and more moth eggs are parasitized. In natural environment or standard insectaria the sex ratio is almost one female for one male or 50 percent females. The antennae hairs were the criteria of female identification. Adult females have a few short hairs/antennae in opposition to males having long and large number of hairs (Grissel & Schauff, 1990).
The experimental work was focused on MNPs utilization to see if it could induce specific conditions to enhance the female proportion in the population frame (Figure 1). Experimental state changed sex ratio in the females favor.

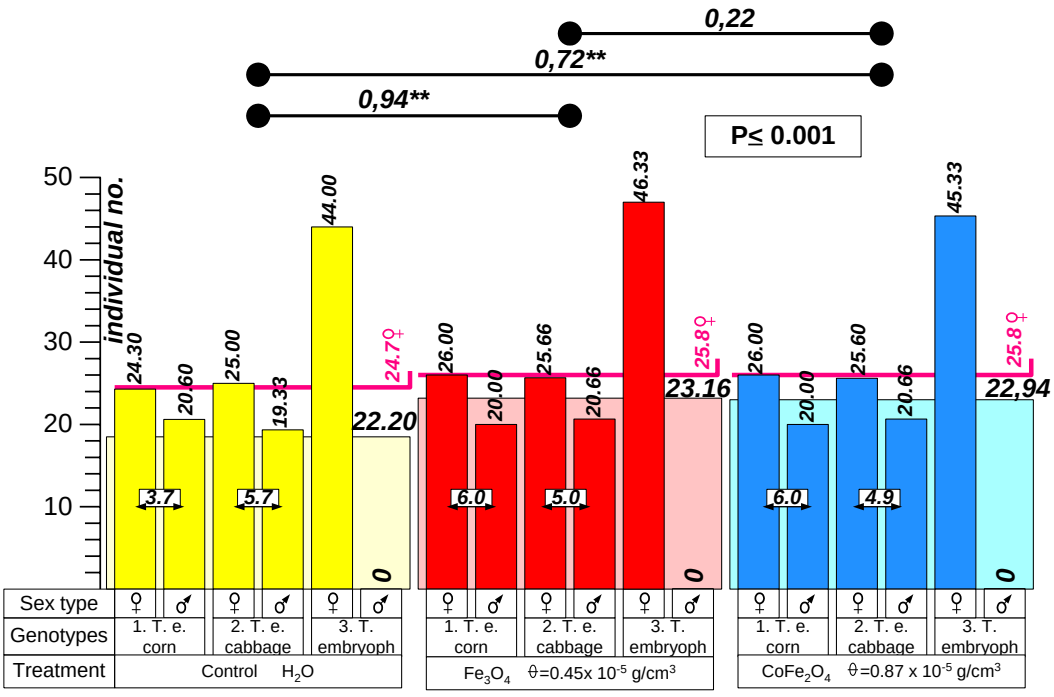

Figure 1. The sex ratio established in experimental conditions and in presence of different types of MNPs

Legend:
- Control – the normal *Trichogramma* adults emerged from *Sitotroga cerealiella* (S.c.) eggs prepared with distilled water;
- γFe_3O_4 and $CoFe_2O_4$ – NM *Trichogramma* adults emerged Magnetic Fluid used for S.c. eggs pretreatment.

Between the population size of control and treatments significant differences were established ($P \leq 0.01$; Fig.1) and it was without significance if γFe_3O_4 and $CoFe_2O_4$ average were compared. Generaly, in NMPs presence the female number was 1.1 higher (25.8♀). It seems a small effect but if we have in mind the huge amount of parasitoids, 230,000 females individuals/ha/launching, then the economical effect is pretty high (an over plus of 5,060 active wasps).

Between *Trichogramma evanescens* ssp corn (*T. ev. ssp. ostriniae*) and cabbage (*T. ev. ssp. brassicae*) distinct behavior was accounted. On *T. ev. ssp. ostriniae* the sex ratio varied from control 1: 0.8 to 1:0.9 and 1:0.7 in the NM descendants of γFe_3O_4 and $CoFe_2O_4$ respectively. On *T. ev. ssp. brassicae* case in the NM population the amount of males was 0.1% higher than in control. It went up from 1:0.7 (Control) to 1:0.8 in both MF treated background. *T. embryophagum* responses pointed out a higher sensitivity to $CoFe_2O_4$ than to γFe_3O_4 (90.66%<92.66%).

2. The prolificacy on *Trichogramma* sp. in NMPs presence

Laboratory experiments for *Trichogramma* breeding required moth fresh eggs. The calculation of *Trichogramma* biological indices were done according to Mencer & Zemshman (1985) method. Each FM female was placed in a glass jar containing cards with host eggs fixed on it. 20 eggs carried the standard cards. In order to emphasize the potential of prolificacy, to set eggs in the host egg, the number of eggs fixed on a card varied from 10 to 100 (Figure 3). The experiment was organized in three replications. The jars were kept at room temperature (25 – 26ºC) at 75 – 80 percent of relative humidity. After 8 days the cards were replaced in Petri dishes and microscopically examined. To establish the prolificacy rates of adult female of *Trichogramma* sp. black eggs and hatching adults were recorded. The number of individuals on a new generation was checked out. The obtained data are presented in Figure 2 and Figure 3.

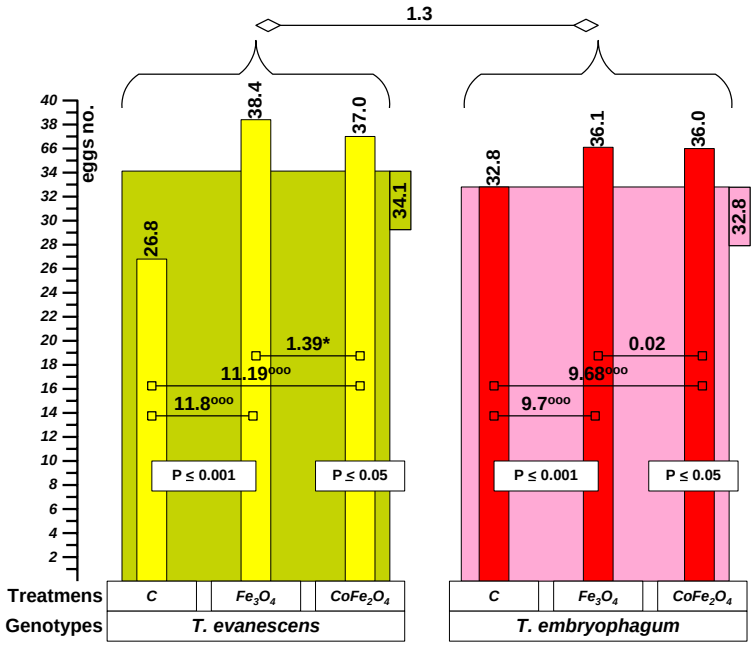

Figure 2. One female of *Trichogramma* sp. parasitism capacity of host eggs treated with different types of MFs

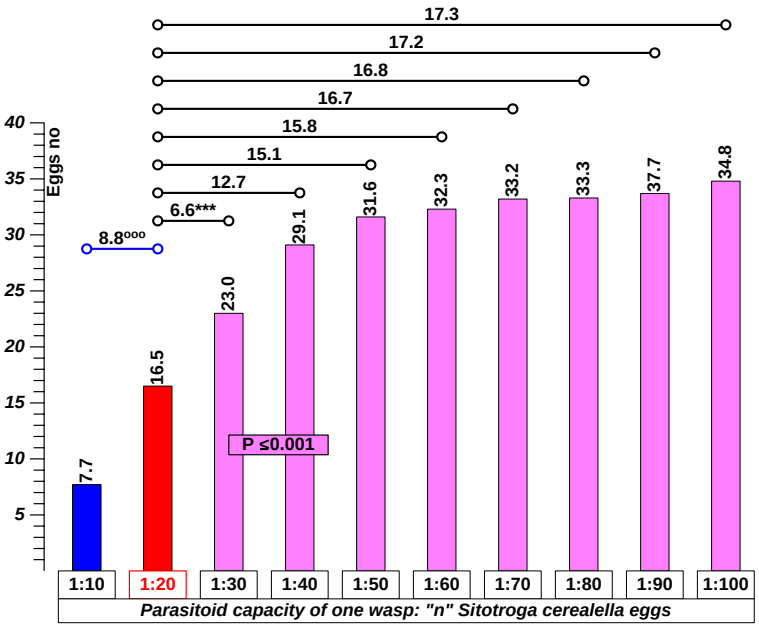

Figure 3. The relation between no. of host eggs proposed for an adult FM *Trichogramma* female and the parasitized eggs capacity

According to obtained data the majority of values of prolificacy were higher when the magnetic fluid γFe_3O_4 was used for host eggs pretreatment (Figure 2). Between general average of species it was a low and insignificant difference (d=1.3). *Trichogramma evanescens* MF reacted more sensitive to different types of Nano Particles. The differences were significant ($P \leq 0.001$). In comparison to Control the differences were d=+11.6 and d=+11.19 for γFe_3O_4 and $CoFe_2O_4$ respectively. *Trichogramma embryophagum* pointed out also significant differences among Control and experimental variants, but the values were smaller (d=+9.7 and d=+9.68 respectively).

Conclusions

The sex ratio was changed when the descendants were breed in MNPs presence. The descendants of *T. ostriniae* and *T. brassicae* reacted differently to γFe_3O_4 and $CoFe_2O_4$. *T. ostriniae* was more sensitive $CoFe_2O_4$ nanomagnetic particles. In *T. brassicae* NM population the amount of males was 0.1% higher than in control.

Acknowledgements

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BIOACTIVE SUBSTANCES FROM THE *NIGELLA SATIVA* SEEDS

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Abstract. The researches performed in the research grant nr. 34,677/2005-2007 have the aim the establish the effects of different bioactive substances, extracted from seeds of some *Nigella sativa* (Fam. *Ranunculaceae*) genotypes. In experiments performed on labor animals (*Mus musculus L.*), was demonstrated the antistress and immunoprotector effect of different bioactive substances extracted from *Nigella sativa* seeds, minimum doses which induced an cytotoxic effect, as well as induced adulterations at the ultrastructural level (liver and/or spleen). In this study, is analyzed comparative, the radioprotective and immunostimulatory effect of different active biological substances extracted from the *Nigella sativa* seeds, towards of some stress factor, in *Mus musculus*.

Key words: *Nigella sativa; Mus musculus;* bioactive substances; antistress and immunoprotector effect.

[1] Introduction

1.1. The biology of *Nigella sativa* species.

Nigella sativa (Fam. *Ranunculaceae*), is an annual plant, native from Mediterranean area and South-West Asia. The plant reaches to 20 - 30 cm in height, having fin-divided leaf, linear. The flowers with 5 - 6 (10) petals, white or pale-bluish (especially in the main rib region). This species is spontaneously or cultivated. The fruit is a capsule, performed from 3 - 7 follicles, each having numerous seeds of a relative triangular shape, black, strongly odorants. The seeds are used, having a piquant flavor, having numerous bioactive substances.

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1.2. History of the pharmacological uses.

The seeds of *Nigella sativa* were meeting in the Tutankhamen tomb, with the role to help him to "passing in other live". In the Old Testament, in the Isaiah book (28: 25, 27), are specified some particularly features for wheat, black fennel (*Nigella sativa*), barley, spelt and millet. In the Greco-Roman ancient, numerous learned, described some species from *Nigella* genus, their property and useful. *Nigella sativa* was described by Hippocrates, Cato Major, Caius Plinius Secundus (1668) [1], Pedanios Discoridou, (1529) [2], a/o. *Nigella aristata* was described by Pedanios Dioscoridou (1529) [2], Fraas, 1845 [3]; Lenz, 1859 [4], a/o.

In Islamic countries, in Koran is attributed to Mohammed prophet this affirmation "the seeds of black cumin (*Nigella sativa*), ameliorate every disease, except to death" [5]. Avicenna maintains that the black cumin seeds stimulate the body strength, help the human organism after fatigue and melancholy.

In Middle Age, Jacob Theodorus Tabernaemontanus (1588) [6] has described six *Nigella species*. In the **Herbarium** of Péter Melius, edited in Cluj in 1578, at least two of the *Nigella* species (*N. sativa* and *N. arvensis*) are mentioned, one as cultivated species and the other as a weed – both largely used as medicinal plants in about 17 recipes [7], [8].

In the **Unani Tib** medical system, *Nigella sativa* is recommended as remedy for numerous diseases: asthma, bronchitis, rheumatism, inflammatory diseases, stimulating of the digestion and lactation in women, the decrease of the renal calculus forming, treatment of the abscess at the abdomen, eyes or some internal organ level, a./o. The oil was used in dermatology (eczema, burns), treatment of fever, remove the dependence from opionids, a./o.

In present-day, the *Nigella sativa* seeds, present many usefulness in human alimentation (as spice at the bread, chase or other aliment preparation), flavones extraction in the perfumery industry, and for many medical purposes. Thus, the seeds of *Nigella sativa* are used in folk medicine in the Mediterranean area, Middle East and in some countries from Asia, for the promotion of good health and the treatment of many ailments including fever, common cold, headache, asthma and hardness in respiration, rheumatic diseases and various microbial infections, expelling worms from intestines and against constipation, diuretic regulation, the amelioration of the tooth and head smarting pain, ulcerations of the mouth [9]. It is also used against scorpion and spider stings and bites of snake, cat and dog, for lactation increase in young woman, against freckles, warts and leprosy, a.o. [2], [10].

The main active principles of the seeds are represented by fixed oil with unsaturated or saturated fatty acids, volatile oil (nigellone, thymoquinone, a.o.), proteins, alkaloids (nigellicine, nigellidine, nigellamine-N-oxide), coumarins, saponins (triterpenes and steroidal), minerals, fibers [10].

In the last decades, the researches over the *Nigella* sp. seeds constituents and their activity were enhanced. The most important findings were:
- nigellones from the volatile oil, confer protection against the spasms induced by histamines;
- beta-sitesterol, used an antitumour sterol;
- thymoquinone, in the oils from seeds, which obstruct the pancreatic cancer, eliminate the cells affected by the apoptosis process stimulating; recommended as an preventive strategy in chemotherapy; a./o.
The researches performed by our collective, point out the following findings:
- A total extract of alkaloids from seeds, manifest an immunostimulating and antistress effect (against the X-radiations; [9], [11]);
- Saponines, poliholosides and volatile oils present a radioprotective and immunostimulating effect, depending on the genotype, bioactive substance, their concentration, a/o; ([12], [13], [14];
- The bioactive substances activity is influenced by genetic structure (COX-2 gene by example [15];
- Bioactive substances from *Nigella sativa* and other medicinal plants (*Aralia mandsurica*), interaction with TiO_2 nanoparticules, deuterium-depleted water [16], a/o.

In this paper is analyzed the effect of a total polyphenols extract from the *Nigella sativa* seeds, as well as the COX-2 gene role in the regulation of the bioactive substances effect.

Material and methods

Biological material. The experiments were performed on the young female of *Mus musculus*, of about 24 g each, and was investigated the liver ultra structural features.

Bioactive substance. A 0.01% extract of different bioactive substances (alkaloids, polyholoside, saponins, and volatile oils) obtained from different *Nigella sativa* genotypes (populations). The animals were intraperitoneal injected, five injections, one at two days, with 0.5 ml with an 0.01% total polyphenols extract, diluted in DDW (depleted-deuterium water), or in distilled water.

DDW (depleted-deuterium water), is a water with a small amount of deuterium. In this experiment was used a water with 30 ppm deuterium, obtained at National Institute for Cryogenics and Isotopic Technologies from Râmnicu Vâlcea (Vâlcea district, România). Previously experiments effected in *Mus musculus* with different bioactive substances, extracted from different plant species, point out the benefic effect of the bioactive dissolved in a DDW with a content of 30 ppm deuterium [17].

Stress factor. Half of experiment animals were irradiated (entire body), one day after the third injection, with an X-rays source (an RUP 150/300 apparatus (ex

Soviet Union provenance) at the following parameters: 250 kV, 5 mA, 1 mm Al filter, D.F. = 500 mm, dose output 0.528 Gy/min, in a unique dose of 5.28 Gy. The experimental variants are presented in Table 1.

Table 1. Experimental variants in *Mus musculus* experiment with bioactive substances (BAS).

Code	Injection	Bioactive substance	X-rays (Gy)
C (Control)	Distilled water	-	-
C – X	Distilled water	-	5.28
DDW	DDW	-	-
DDW – X	DDW	-	5.28
BAS in distilled water	BAS in distilled	Bioactive substance	-
BAS in distilled water	water	Bioactive substance	5.28
- X	BAS in distilled	Bioactive substance	-
BAS in DDW	water	Bioactive substance	5.28
BAS in DDW – X	DDW		
	DDW		

Electron microscopy investigations. At a day, after the last injection, the experiment animals were sacrificed through section of the jugular vein. For the electron microscopy analysis, the pieces of about 1 mm^3 in volume, from liver, were prefixed in 2.5% glutaraldehyde solution, postfixed in a 1% Milloning fixation and included in EPON 812. The serrated sections of about 90 nm thick were contrasted with acetate de uranyl and lead citrate and analyzed at a TEM Philips CM 120 microscope (in *Ovidius* University from Constanţa), or at a TEM JEM JEOL 1010 electron microscope (in Electron Microscopy Center from *Babeş-Bolyai* University, Cluj-Napoca).

Results and discussions

Experiment with alkaloids total extract. Ultra structural features of the liver.

Control variant. The structural features in the control variant are characteristic for this organ and specie [18]. The hepatic lobule present a centro-lobular vein covered with an epithelium. Around the centro-lobular vein, are disposed the sinusoid capillary. The hepatocytes of polygonal shape are disposed in rows. Every hepatocyte present one (two) nuclei of oval-spherical shape. In cytoplasm are present numerous mitochondria, normal structured, with an electron-dense matrix (Figure 1). Among mitochondria are dispersed a rugous endoplasmic reticule formed from narrow profiles, usually disposed around the mitochondria (Figure 1).

At the vascular pole, the hepatocytes present microvillus evaginated in the Disse space. In sinusoid capillary, there are Kupffer cells with numerous lysosomes and with a normal activity. Smooth endoplasmic reticule, as well as the dictyosomes, is poor represented. The lipids drops are present in a small quantity, being represented through small drops, disposed with predilection toward the vascular pole (in transit; Figure 2).

In Control variant, and in other experimental variants, in hepatocytes were observed some parasite entities (viruses), and some filamentous structures as result of the metabolic activity [19].

Figure 1. Control, mitochondria.

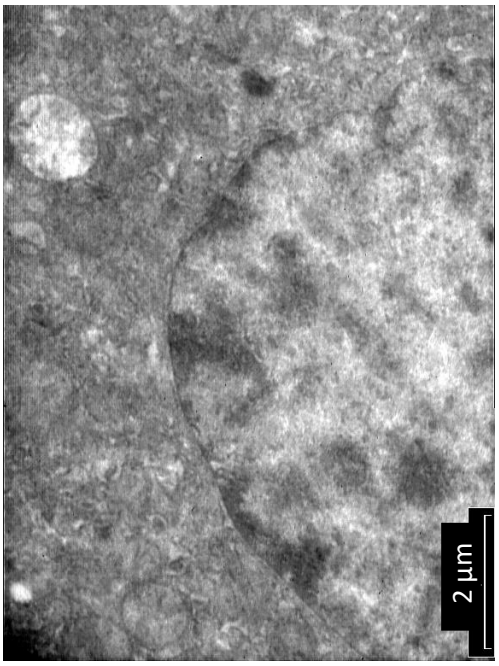

Figure 2. Control, nucleus.

Control-X. (the X-irradiated effect). Comparatively with the Control variant, under action of the X-rays, were induced some adulterations. The hepatocytes nuclei present an unregulated shape outline (Figure 3). In some of them, the nuclei are hypertrophied, especially the vacuole and pars amorphous components of the nucleolus. The smooth endoplasmic reticule is proliferated, as reaction at the destructive action of the X-rays. Rugous endoplasmic reticule presented dilated cisterns, and little ribosome's associated, because of the diminished of the metabolic activity and of the protein synthesis (Figure 3). Also, was emphasised a depletion of the glycogen. In some hepatocytes, in which are present small focuses of cytoplasm lyses, the nuclei are pycnotic and hyperchrome, as well as a

lipid accumulations under shape of drops of different size. As result of the advanced of the adulteration in the hepatocytes, the plasmalemma was destroyed the cellular compounds being free in sinusoid capillary. In some hepatocytes, the perinuclear space is dilated and the chromatin is uniformly (a degradation process). The Kupffer cell is inactive (Figure 4) and in the Disse space is present accumulation of glycogen.

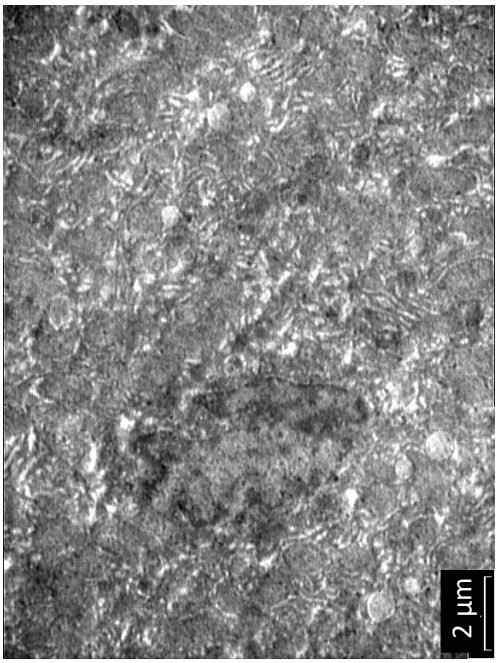

Figure 3. Control-X. Cell with dilated REG, and nucleus with undulated outline.

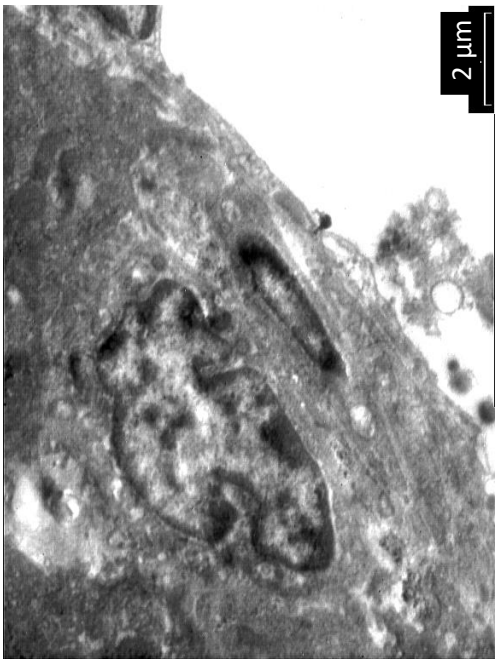

Figure 4. Control-X. Kupffer cell in activity.

DDW effect. In comparison with Control variant, the hepatocytes present some slight adulterations which not affect significant the cell metabolism. The nuclei present a structure almost normally with a spherical-oval shape and with heterochromatin disposed in the electron dense blocks at their periphery. In cytoplasm are present numerous mitochondria which present their matrix slightly electron-dense in comparison with the Control variant. The rough endoplasmic reticule is in an intense activity, in comparison with the Control variant, being disposed in parallel profiles, apt for the protein synthesis, but present some slightly dilatations (Figure 5). Also, the smooth endoplasmic reticulum is hypertrophied in comparison with the Control variant, being implicate in the detoxification process (Figure 5). At the vascular pole, the hepatocytes present numerous microvilli, which denote an intense activity of absorption of the

metabolites. In some hepatocytes, is observed a slightly lipids retention. Not are present the collagen accumulation in the Disse spaces.

The Kupffer cells, present a normal activity, having many lysosomes (Figure 6). In the macrophages are present the primary lysosomes and the cellular residues.

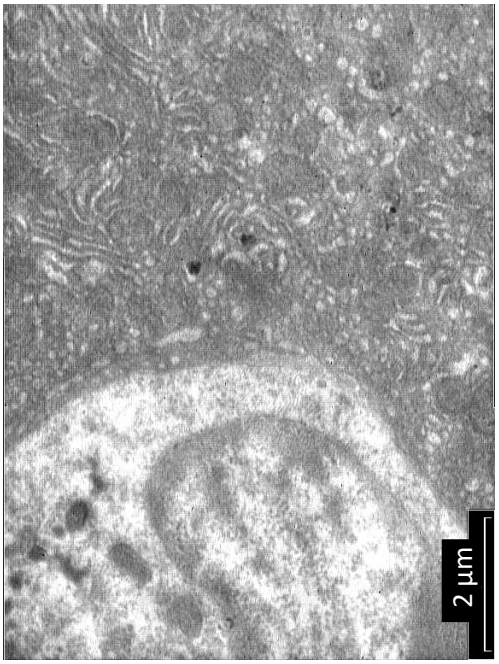

Figure 5. DDW. Hypertrophied SER and RER.

Figure 6. DDW. Kupffer cell with lysosomes.

DDW-X. (The irradiation in the DDW presence effect) On the basis of the slightly adulteration induced by the DDW presence in hepatocytes, the X-irradiation accentuated the adulterations effect of the hepatocyte ultrastructure. This suggests that DDW not present a radioprotective effect. In this variant, the amount of rough endoplasmic reticule is bigger represented in the cell, in comparison with the case of the irradiated animals. Also, in the case of combined action of the DDW and a stress factor (X-rays), the drops lipids is in a smaller number in the cells, in comparison with the Control, unirradiated or irradiated. The nuclei present an irregular contour, and in generally the chromatin is rarefied. The nucleolus is hypertrophied and the vacuole component and pars amorphous are enhanced quantitatively, or with an adulterated structure (Figure 7). The cytoplasm matrix is rarefied, with many lyses area, of small size. Also, was observed a reduction of the number of cytosol ribosomes. Mitochondria are present in a smaller number, being polymorphous as size and shape. As effect of

the X-irradiation, in hepatocytes are maintained a high quantity of rough endoplasmic reticule.

At the vascular pole of the hepatocytes, the plasmalemma of some cells is dense, many compounds migrates in sinusoids (Figure 8).

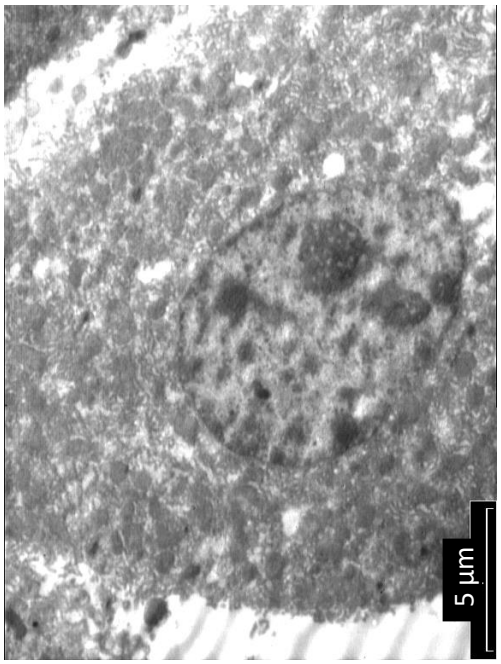

Figure 7. DDW-X-rays. Hypertrophied nucleolus.

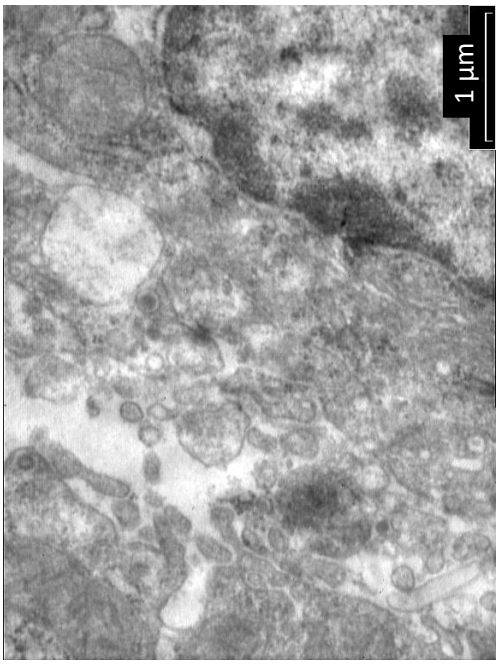

Figure 8. The vascular pole of hepatocyte.

Alkaloids in DDW (the alkaloids extract diluted in DDW effect). The application of the alkaloid extract in DDW, not affect the normal structure of the hepatocyte. The nucleus presents a polymorphism regarding their shape and the stage of cellular cycle. In some cells, the chromosomes are well structured, the cells being in an intense metabolic activity (Figure 9). In the cells are present an accumulation of lipid drops. The rough endoplasmic reticule is disposed in parallel profiles, having numerous ribosome's, propitious for the protein synthesis (Figure 10). The mitochondria present an electron dense matrix and cristas poor represented. The vascular pole of the hepatocytes, present a different structure, depending on the hepatocytes position. At the hepatocytes situated toward the periphery of the hepatic lobule, the microvillus are evaginated in the Disse space, while at the hepatocytes situated towards the centro-lobular vein, the microvillus are absent.

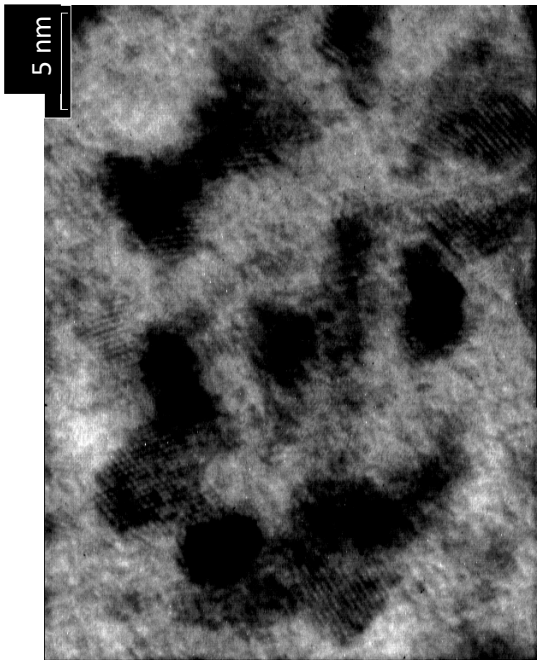

Figure 9. Alkaloids in DDW. Nucleus with chromosomes.

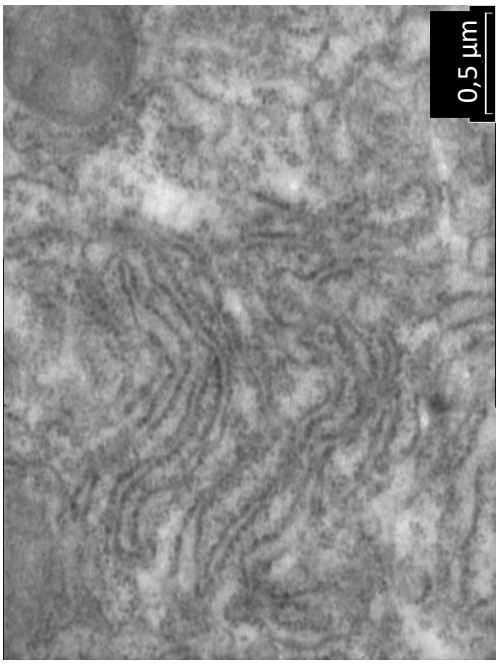

Figure 10. Alkaloids in DDW. RER and mitochondria.

Alkaloids in DDW – X (X-irradiation in the alkaloid extracts presence diluted in DDW). The ultrastructural modification induced by the X-rays, in the presence of the DDW, were major in comparison with the adulteration recorded under the action of the X-rays alone. In some cells, the nucleus is of normal shape, with heterochromatin disposed in blocks in its inner as well as on the inner part of the nuclear envelope. The smooth endoplasmic reticule was in a bigger quantity, and rough endoplasmic reticule presented the slightly the dilated profiles. In other cells, the cytoplasm presents lyses areas, rough endoplasmic reticule cistern dilated and nucleus with rarefied chromatin. The mitochondria presented a slight polymorphism, in comparison with the alkaloid extract application alone. Their matrix is electron-dense and cristas are poor represented. At the vascular pole, the microvilli are rarefied. The Kupffer cells are inactive, without lysosomes. The collagen fibbers are well represented, as well as lysosomes (Figs. 11, 12). Participation of the lysosomal apparatus of hepatocytes in collagen resorption during regression of cirrhosis of the liver was studied by Ryvnyak (1984).

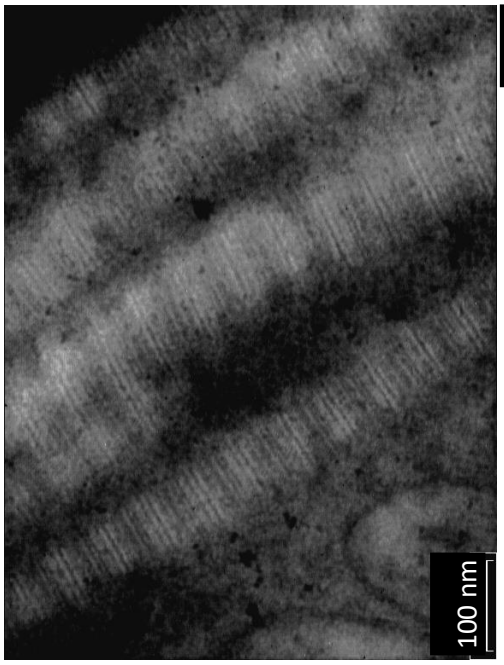

Figure 11. Alkaloids in DDW – X-rays. Collagen fibers.

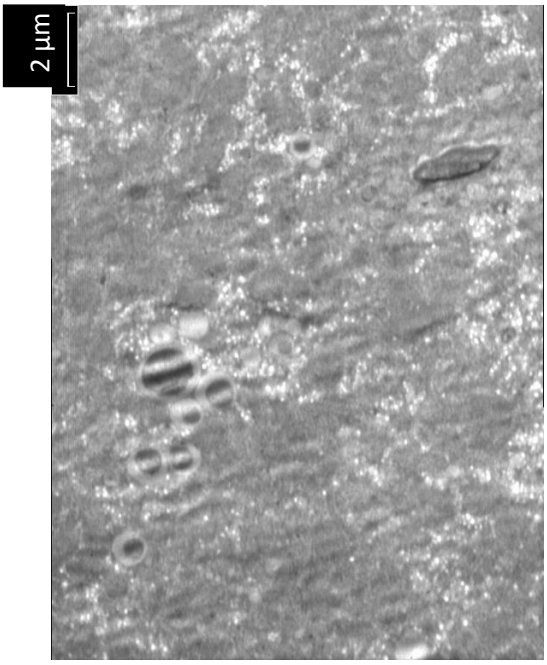

Figure 12. Alkaloids in DDW – X-rays. Collagen fibers and lysosomes.

Alkaloid diluted in distilled water (the effect of alkaloid extract diluted in distilled water). The cell ultrastructure is not affected in the administration case of the alkaloids dissolved in distilled water. The nucleus ultrastructure is normal, with fine blocks of heterochromatin dispersed in its inner or near nuclear envelope (Figure 13). The mitochondria present also a normal structure with a matrix compact and long and numerous cristas in inner. The endoplasmic rugged reticule and the smooth endoplasmic reticule are well developed (Figure 14). In some cells, the endoplasmic canalicules are dilated having a cistern structure. The vascular pole of the hepatocytes, present numerous vilosity. Near the sinuous capillary are present Kupffer cells in metabolic activity.

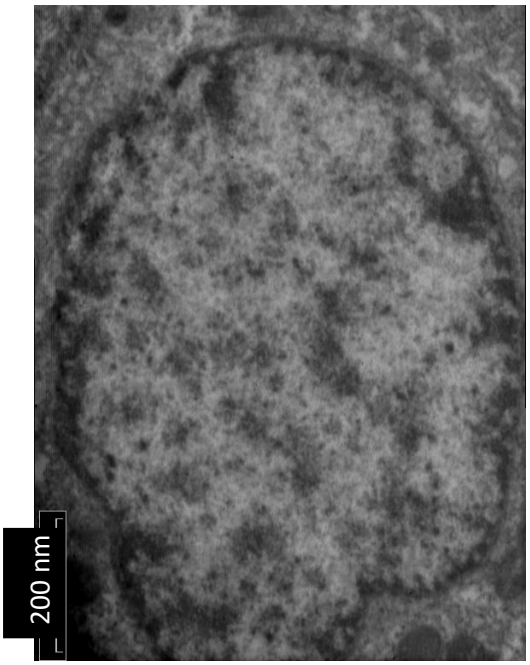

Figure 13. Alkaloids in distilled water. Nucleus with normal structure

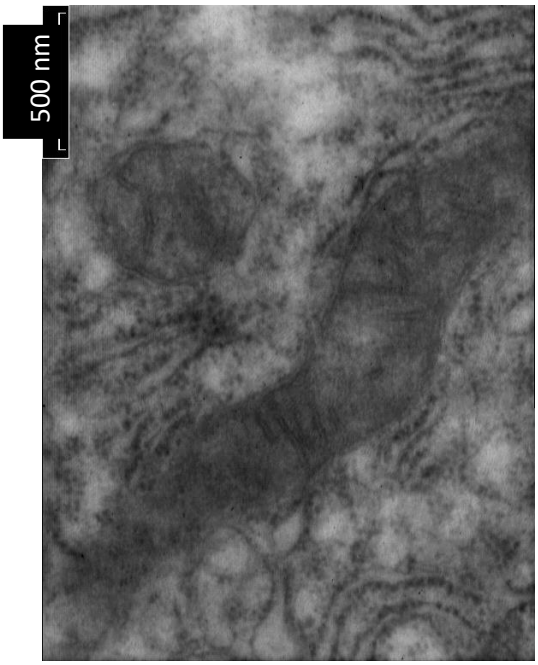

Figure 14. Alkaloids in distilled water. Mitochondria and RER.

Alkaloid diluted in distilled water – X. X-irradiation in the alkaloid extracts presence (diluted in distilled water). The presence of the alkaloid diluted in distilled water, has a radioprotective effect, in comparison with the ultrastructure features recorded at the alkaloid presence diluted in DDW.

The nucleus present a normal structure with heterochromatin fine disposed in its inner or near inner nuclear envelope. Also, the nucleolus presents their structural components, being in an intense metabolic activity (Figure 15). Some of the mitochondria present a normal structure, while other presents an adulterated structure. In this case, their matrix present some rarefied regions, and the cristas are a few and of a short length.

The endoplasmic reticule is well represented, sometime their canalicles being dilated, of a cistern aspect (Figure 16). The vascular pole of the hepatocytes is in generally, well represented. The sinusoid capillary present sometimes in its inner, hepatocytes and cell detritus. The cells Kupffer are pre-eminent in the sinusoid capillary.

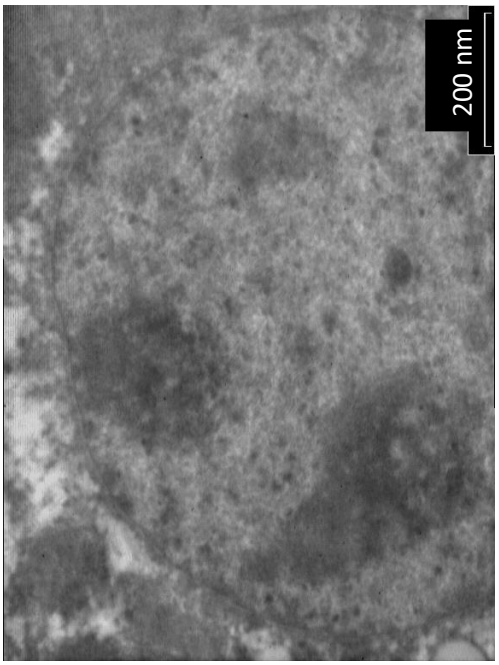

Figure 15. Alkaloids in distilled water – X-rays. Nucleus with normal ultrastructure.

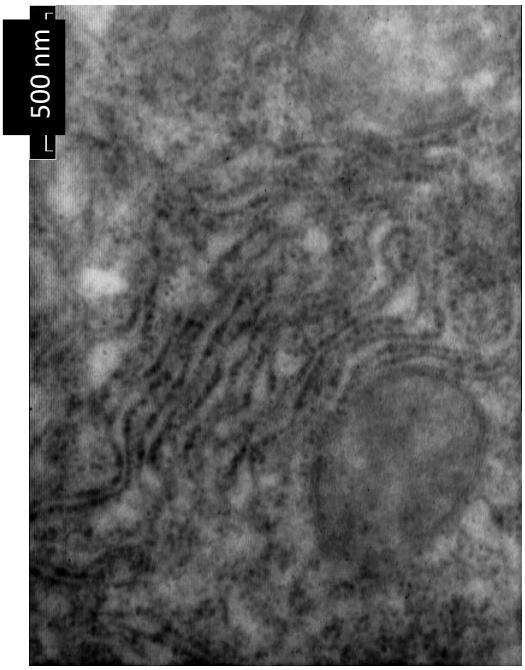

Figure 16. Alkaloids in distilled water – X-rays. Mitochondria and RER.

2. The interaction between a bioactive substance (total alkaloids extract) and COX-2 gene. Under action of the two exogenous factors (DDW and X-rays), the hepatocyte is reversible adulterated. In a hepatocyte with a normal mitotic activity, the effect of the alkaloids extract was dependent on the cells (hepatocytes) position, toward the cento-lobular vein. In the lymphocytes from the Malpighi lymphatic corpuscle, with a high mitotic activity, the total extract of alkaloids diluted in DDW, present a radioprotection effect.

The diminished of the deuterium content from water, probably inhibited the COX-2 gene function. This gene is implied in the prostaglandin synthesis. The alkaloids extract, amplified this action in the cells with quick mitotic activity, normal or pathological.

3. Experiments with polyholosides and saponins from *Nigella sativa*.

Saponins from *Nigella sativa*, unirradiated animals. Are induced slightly, reversible modifications as: a dilatation of the Centro lobular vein and erythrocytes disposed on the endothelium. Around the centro lobular vein, the hepatocytes are ordaining disposed. Also, is present a stasis process at the centro lobular vein level. In nucleus from the pericentrolobular hepatocytes, the heterochromatin is pulverized.

Saponins from *Nigella sativa*, irradiated animals. In the centro lobular vein is present a stasis phenomenon, the erythrocytes being adherent on the epithelium of the centro lobular vein. In sinusoid capillary, the erythrocytes are disposed under a roll shape. There is present a reduced amount of nuclear chromatin, which is homogenous, disposed in fine rows.

Polyholosides from *Nigella sativa*, unirradiated animals. Present a stasis process in the centro lobular vein, and a slightly stasis process in the sinusoid capillary. In the nuclei, agglomerations of heterochromatin are present at the periphery. Nucleoli are hypertrophied.

Polyholosides from *Nigella sativa*, irradiated animals. The liver presents structure characteristics for an intense metabolic activity. In some cells two nuclei are in an adjacent position, suggesting a mitotic division activity. The chromatin is fine disposed, being present also the NAB's structure (nucleolus associated body's), which indicate an intense metabolic activity as result at the animal adaptation at the action of this stress factor.

4. Experiment with polifenols from *Aralia mandshurica*.

Control. Hepatocytes present a normal ultrastructure. They present usually one (two) nuclei, with smooth outline, and numerous mitochondria. The rugous endoplasmic reticulum is well represented, while the smooth endoplasmic reticulum has a discrete presence, being evidently through many vesicles. In hepatocytes are present a small amount of lipids drops. Dyctiosomes, glycogen, a/o. The Ito cell present a small amount of lipids and the Kupffer cell is in a normal activity.

Control – X rays. In hepatocytes are present numerous lipid drops. As result of action of a stress factor, the nucleus outline is unregulated, in nucleoli being present some vacuolarizations as well as in the heterochromatin areas. In mitochondria, the crista numbers is reduced. In the Ito cell are present small lipid drops. The Kupffer cell is active, having lysosomes, pynocitosis vesicles, and the cell rests.

DDW. The cell react at this exogenous substance, being affect the water metabolism. Thus in hepatocyte is present a big amount of lipid drops. Nucleus is normal, but presents an enhanced of the vacuolar component of the nucleoli. Also, take place a proliferation of the smooth endoplasmic reticulum, this organelles having an important role in the detoxification processes. In hepatocyte is present a small amount of glycogen. The Kupffer cell presents lysosomes in metabolic activity.

DDW - X rays. DDW action as a scavering of the free radicals, the amount of lipid drops being reduced and lesions induced by X-rays being limited. Thus nucleus and mitochondria present a normal ultrastructure. Smooth endoplasmic reticulum is well represented, the glycogen is in a small amount, and collagen

fibers are absent. In Ito cell are present some lipid drops, of different size. Kupffer cell present lysosomes and phagocytes products.

Polyphenols in DDW. Hepatocytes present a normal structure, the nucleus having a smooth, normal outline. In cell are present numerous lipid drops, and the glycogen is practically absent. Cellular organelles (mitochondria, endoplasmic reticulum) present a normal structure. In the Ito cell the lipid drops are practical absent. The Kupffer cells contain lyzosomes, hematin and destroyed material. Capillaries without stasis processes.

Polyphenols in DDW – X rays. The presence of the polyphenols in DDW in the time of the stress factor action (a sub lethal dose of X-rays), confer a total protection vs. X-rays, the hepatocytes having a structure similar to Control. In the Kupffer cell are present primary and secondary lyzosomes with residual corps (phagocyte of cellular rests destroyed). Some sinusoid capillaries are slightly congestion and microvillus preeminent in the Disse space.

Conclusions

Under action of a source of X-rays of sublethal value (5.28 Gy), the hepatocyte ultrastructure is adulterated, especially the nucleus, mitochondria and endoplasmic reticule. Also, are affected the quantity of the lipids drops and glycogen amount from the cells, as well as the Kupffer cell ultrastructure.

Under action of the DDW, are established some slightly adulteration of the hepatic cells, which didn't affected significantly the cell metabolism. In principally, DDW adulterate the lipid metabolism, in hepatocyte being present a great number of lipid drops.

The DDW presence in the time of X-irradiation of the animals, reduce very significantly the injuries produced by X-irradiation at the liver level, the ultrastructural features being appropriate to Control animals.

The application of the alkaloid extract in DDW, affected the normal structure of the hepatocytes.

The alkaloid extract administered in distilled water, did not affected the normal structure of the hepatocytes, their structure being similarly with the Control.

The presence of the alkaloid extract diluted in distilled water, in the time of the animal irradiation, manifested a protector effect at the liver level.

The experiments performed with a total extract of alkaloids from *Nigella sativa* seeds, offer informations about the COX-2 gene activity. The COX-2 gene activity (implied in the prostaglandin synthesis), is affected by the cell content in deuterium. The reduction of deuterium content from water has as effect an inhibition in the COX-2 gene function.

The acute X-irradiation of the whole body in the presence of polyholosides extract from Nigella sativa seeds, manifest a radioprotective effect at the liver level in *Mus musculus*.

The saponins extract from *Nigella sativa* seeds, applied alone, induced a slightly adulteration of the liver structure.
The presence of saponins extracted from *Nigella sativa* seeds in the time of X-irradiations of the animals, induce a slightly protection.
A 0.01% total polyphenols extract from *Aralia mandshurica*, diluted in DDW, not induced cytotoxic effects.
The X-irradiation of the animals in the presence of DDW and a total polyphenols extract from *Aralia mandshurica*, manifest a strong stressprotector effect.

Acknowledgement.

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STUDY OF RED WINE PRODUCED IN THE TUTOVA AREA, ROMANIA

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Abstract. Dark red and very sweet common grape grows in most rural areas in the Tutova Area. From these grapes a dark red wine is made. It is a semi-dry to dry wine with a high content of energizing substances. As this kind of wine is drunk by some 300,000 locals, we undertook to conduct research on this wine. The research contained phytochemical studies to determine the active principles groups constituent of the wine; determination of microelements constituents via atomic absorption spectrophotometry, performed with Wizard application, AA-6200 Shimadzu equipment; determination of resveratrol content, via HPTLC thin-layer chromatography, by means of Wincats application, CAMAG equipment. The findings of the research revealed the presence of flavonoids, vitamins and anti-oxidant products is by far superior to many other kinds of domestic as well as European wines.

Key words: Tutova, common grape, wine, spectrophotometry, chromatography.

1. Introduction

Plantavorel Piatra-Neamt launched a programme aiming at researching red and purple wines produced in various area of Romania with a view to using such wines in preparing tonic beverages with enhanced phytotherapeutic properties. The quality of the wine used in tonic beverages is the only selecting criterion.

Wine is a hydro alcoholic solution, which contains very many substances that differ from the point of view of their chemical structure but having a well-defined role with a well-known qualitative and nutritive value. The phytotherapeutic properties of wine are given by the group of active principles and microelements contained by ripe grapes.

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The currently available literature points to the following groups of active principles and microelements contained by red and purple wines:

1. FLAVONOIDS

Flavonoids are a group of crystalline chemical compounds to be found in plants, discovered in 1936 by the Nobel Prize Laureate Albert Szent Gyorgyi. He later called them vitamin P. Since its discovery, scientists have isolated over 4,000 flavones. Flavonoids are sometimes called *bioflavonoids,* a term often used to describe biologically active flavonoids. Recently, interest in flavonoids has grown significantly a greater attention owing to their impressive antioxidant properties. Some of these compounds seem to be more efficient than common antioxidants, e.g. vitamins C and E via their effect such as protecting low-density lipoprotein (LDL) from oxidation. Research have revealed that bioflavonoids reduce the level of cholesterol, providing further protection against cardiovascular diseases, having antiviral, anticarcinogenic, anti-inflammatory, and anti-histaminic qualities.[2, 10]

Dr C. Kandaswani's and Dr G. Middleton's research proved how efficient some flavonoids are in preventing and treating various cancer forms. [2, 10]

2. POLYPHENOLS

A large class of active principles is represented by phenolic compounds, which are widely spread substances in plant regnum, abundance probably exceeded only by glucidic substances. Phenolic compounds have very different structures whose complexity takes the most unexpected shapes. They appear in plant metabolism ranging from the simplest phenols, e.g. *hydroquinone* or *pirocatehol*, to high molecular weight macromolecules (higher lignin). Polyphenolic compounds in plants may be formed from of one or more free or condensed benzenic cycles or of mixed and heteroclite benzenic cycles.

Phenolic compounds may diversify according to the number of hydrophile groups grafted on the nucleus (plant polyphenols) or by the formation of other functional groups such as metoxiles, carboxiles, aldehyides, ketones, etc.

Phenolic compounds can be found in small quantities in wine [2, 11]. These compounds contribute to defining the organoleptic characteristics, the hygiene-sanitary value, and mainly, the typical characteristics of wines. Due to their bactericide and anti-oxidant properties, phenolic compounds protect especially the colour and the taste of red wines.

The class of phenolic compounds also contains phenolic acids, i.e. organic combinations, whose molecule contains the functional carboxyl (-COOH) and hydroxyl (-OH) group linked to the aromatic nucleus. This category also includes hydroxibenzoic and hydroxicinnamic acids. [11]

Grapes, especially the purple ones, and oak wood contain some more complex polyphenols, which belong to the stilbenic family, whose benzenic cycles are linked by an ethane –CH_2-CH_2– or ethenic –CH=CH bridge. Resveratrol is one of these stilbenic compounds, produced by the grape vine in response to mould attack (Langcake, 1981) and is located in the grape skin, and later extracted while making the wine in red in 1-3 mg/l quantities. The health benefits of resveratrol have been recently revealed. [2,11]

3. ANTHOCYANS

Anthocyans are the pigments that give the red, purple or bluish colour of the flowers, fruit, and seed skin. They are characterised as benzopyril, due to the formation of pyroxane cation. [2]

In red wines, they amount 2,200 – 250 mg/l and such quantities decrease during the first year of storage, to 200 mg/l. [11]

4. AMINO ACIDS

The literature shows that there are 32 amino acids identified in wine. The wine content of amino acids varies largely depending on the species of grapes the wine was made of, the wine making technology, and the micro organisms that performed the various fermenting stages. Amino acids are uniform molecules with a general formula R-CH(NH_2)-COOH, where R may be an atom of hydrogen (in the case of glycine, for instance) or hydro carbonate chain. In the case of multifunctional amino acids on R radical, there are other acid-like groups grafted, e.g. (-COOH), basic (-NH_2) or neutral (-OH) (serine, tyrosine or thyronine, -SH in cystine methionine). In wines, the total amino acid quantity varies between 0.01-0.2 g/l. [3,10]

5. CARBOHYDRATES

Carbohydrates play a very important role in the taste of wines. Hence, dry wines contain 2-3g/l sugar and are easily felt when tasted. The types of carbohydrates are very important as the tasting impression of wine changes according to such type. Dry wines generally lack glucose whereas fructose, pentose is between 0.2-0.3g/l. [3, 11]

6. VITAMINS AND ENZYMES

The vitamin content of wines is generally low but in terms of quality, they contain all the vitamins necessary to life, playing thus the role of growth factor indispensable to yeast and bacteria.

Among the vitamins found in wines, a sizeable amount is group B vitamins (thiamine, riboflavin, pyridoxine, and mesoinositol), vitamin PP, panthothenic, acid and biotin. [11].

1. Materials and methods

Materials:

- Red wine in the Tutovei area, location: Epureni, Vaslui; wine maker: Vasile Marcu
- Specific reactive substances to determine acids, flavones, total polyphenols, polyphenolcarboxylic acids, amino acids, anthocyans, proanthocyans, vitamins, fructosans, reactive substances listed in Farmacopeea Romana, volume X.

Equipment:

- Atomic Absorption Spectrophotometer AA – 6200 Shimadzu/2006, Wizard application;
- Thin-layer Chromatograph HPTLC CAMAG, Wincats application.

As a result of physical-chemical tests, the main physical and chemical characteristics of wine were determined: dry substance, pH, density, alcohol content, and acidity [5].

The phytochemical studies revealed the main chemical compound groups which form the active principles of wine: flavones [5], polyphenols [1,7], amino acids [6], anthocyans [4], proanthocyans [6], vitamins (vitamin C) [5], fructosans [6], antioxidant activity [7].

The experimental results are given in Table 1.

Table 1. Quantitative tests on the main physical and chemical characteristics of some active principle groups in the dark red (black) Tutova – Epureni, Vaslui wine.

No.	ACTIVE PRINCIPLE	TUTOVA RED WINE (% g/l)
1	Dry substance	2.94
2	pH	3.80
3	Density	0.9952
4	Alcohol level, %, m/V	10.62
5	Acidity	14.6;0.86
6	Flavones expressed as rutoside, g/l	0.017
7	Polyphenols-carboxylic acids, expressed as cafeic acid	0.00199
8	Total polyphenols, expressed as gallic acid	0.056
9	Amino acids, expressed as glutamic acid	0.136
10	Anthocyans expressed as cyanidol chloride	0.106
11	Proanthocyans, expressed as cyanidol chloride	1.42
12	Vitamin C	0.312
13	Total fructosans, expressed as fructose	0.1701
14	Antioxidant activity	77.63

Acidity = mval/l or g/l sulphuric acid, or g/l acetic acid.

The Romanian regulations provide a maximum content of 24 mval/l – 1g H_2SO_4 l/wine for red wines.

Microelements analysis

Microelements tested: K, Na, Ca, Cu, Zn, Fe, Mg, Mn, Co, Pb.

Method applied for the test: Atomic absorption AA -6200 Shimadzu, Wizard program. Experimental results are given in Table 2 and Figure 1, respectively.

Table 2. Experimental results for K element.

No	*Action*	*Sample*	*True Value*	*Conc. (ppm)*	*WF*	*VF*	*DF*	*CF*	*Actual Conc.*	*Actual*	*%RSD*	*SD*
0	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*
1	STD 1	10.0000		0.1778							1.5474	0.002
2	STD 2	5.0000		0.1043							3.5645	0.003
3	STD 3	3.0000		0.0642							2.0369	0.001
4	STD 4	1.0000		0.0210							5.8284	0.001
5	RED WINE		4.5661	0.0850	1.0	1.0	250.0	1.0	1141.5	ppm	0.3328	0.000

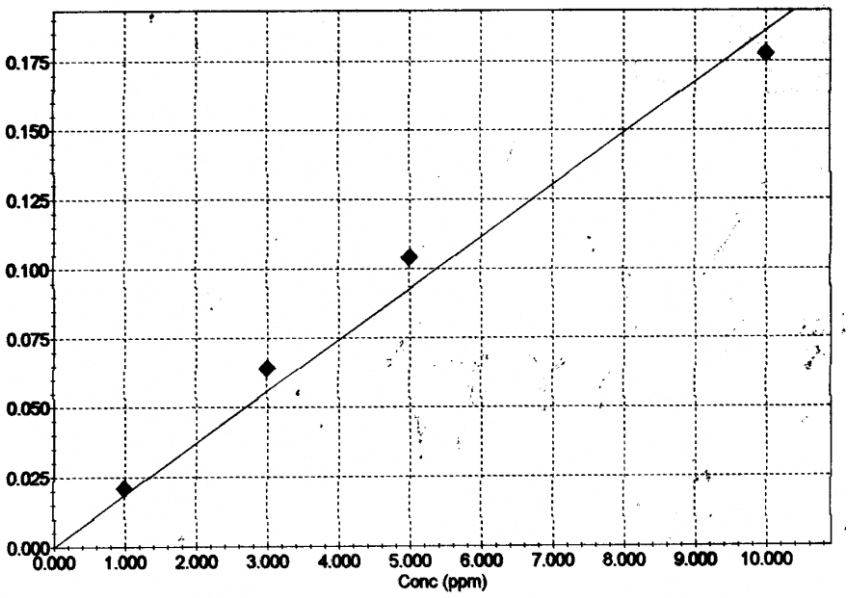

Figure 1. Element K Standard curve.

The other elements were determined in a similar manner.
Results are given in Table 3.

Table 3. Content of wine elements (ppm)

No	*Element*	*True Value*	*Conc. (ppm)*	*WF*	*VF*	*DF*	*CF*	*Actual Conc.*	*Actual*	*%RSD*	*SD*
0	*1*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*
1	*Na*	8.1488	0.0093	1.0	1.0	1.0	1.0	8.1488	ppm	0.0000	0.000
2	*Ca*	3.4789	0.4044	1.0	1.0	11.2	1.0	38.963	ppm	1.3289	0.005
3	*Cu*	0.3305	0.0315	1.0	1.0	1.0	1.0	0.3305	ppm	0.0000	0.000
4	*Zn*	-0.0987	-0.0478	1.0	1.0	1.0	1.0	-0.098	ppm	15.2209	0.007
5	*Fe*	1.6921	0.1246	1.0	1.00	1.00	1.0	1.6921	ppm	4.6535	0.005
6	*Mg*	0.1768	0.3463	1.0	1.0	1120	1.0	198.01	ppm	0.5570	0.001
7	*Mn*	1.2967	0.2674	1.0	1.0	1.0	1.0	1.2967	ppm	1.0315	0.002
8	*Co*	1.2967	-0.0020	1.0	1.0	1.0	1.0	1.2967	ppm	1.0315	0.002
9	*Pb*	1.2967	-0.0020	1.0	1.0	1.0	1.0	1.2967	ppm	1.0315	0.002

Determination of resveratrol-content in wine via thin-layer chromatography

Resveratrol phytoalexin was first discovered in grape skin and then in wine.

Resveratrol is a phytoalexin of the antibiotic class produced by some plants as a defence mechanism against infection.

Resveratrol (3,5,4,-trihydroxystilbene) is a polyphenolic phytoalexin. It is a stilbenoid, derivative of stilbene and is produced by plants with the help of stilbene enzyme. There are two isomers: CIS-(Z) and TRANS-(E). The *trans* isomer may be isomerised under the form *cis* when heated or exposed to ultraviolet radiation.[10]

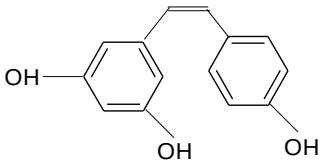

Figure 2. *CIS*-resveratrol

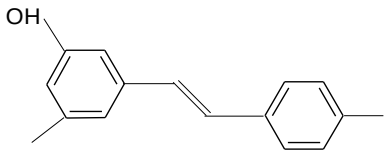

Figure 3. *TRANS*-resveratrol

Resveratrol is found in grapes, wine, grape juice, bilberries, and blackberries.

Phytotherapeutic properties of resveratrol:
- 50 times stronger antioxidant than vitamin E and C together;
- lowers total cholesterol level in blood;

- controls osteoporosis;
- administration of resveratrol increases sirtuin activity, the enzyme which prolongs life by 70-80%.[9]

METHOD APPLIED – HPTLC Chromatography CAMAG/winCATS

Analysis Report .

Method C:/CAMAG/winCATS/Data/ chromatographic photos
Research/Dosage RESVERATROL
- red wine, FIC 25 cme

Validated Design

STATIONARY STAGE

Chromatographic plate (X x Y) 10.0 X 10.0 cm
Material silica gel plate 60 F 254
Manufacturer E. MERCK KGaA

MOBILE STAGE

Solvent: Chloroform: ethyl acetate: formic acid = 25:10:1
Position in solvent 87.0 mm
Solvent volume 36.0 ml
Temperature 21
Time 15 min.
Simple application: CAMAG Linomat IV
Volume syringe used 100 µl
Band layer start at: 12.0 mm
Band width: 8 mm
Space between bands: 9 mm

Table 4. Solutions applied

No.	*Position applied*	*Value applied*	*Name of samples*	*Sample quantity*
0	*1*	*2*	*3*	*4*
1	16.0 mm	2 µl	Resveratrol 1	330 mg
2	33.0 mm	3 µl	Resveratrol 2	500 mg
3	50.0 mm	4 µl	Resveratrol 3	660 mg
4	84.0 mm	12 µl	Red wine 4	

The double developing camera CAMAG 10 cm saturated was used with 30-minute developer.

In Figure 4 the chromatoplate presented, where 5 bands can be noticed, of which bands 1, 2, 3 are resveratrol standards corresponding to the resveratrol quantity applied: 2µl, 3µl, 4µl, and bands 4 and 5 are the red wine samples.
Chromatoplate processing was conducted by means of CAMAG TLC Scanner 3 "Scanner 3" S/N 070823 equipment.
Band length used: 318 nm
Lamp: D2/W
Measuring technique: Absorption

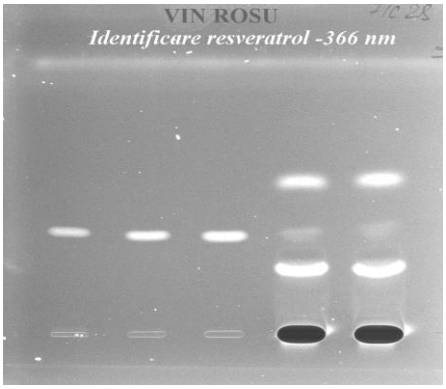

Figure 4 Chromatoplate resveratrol analysis

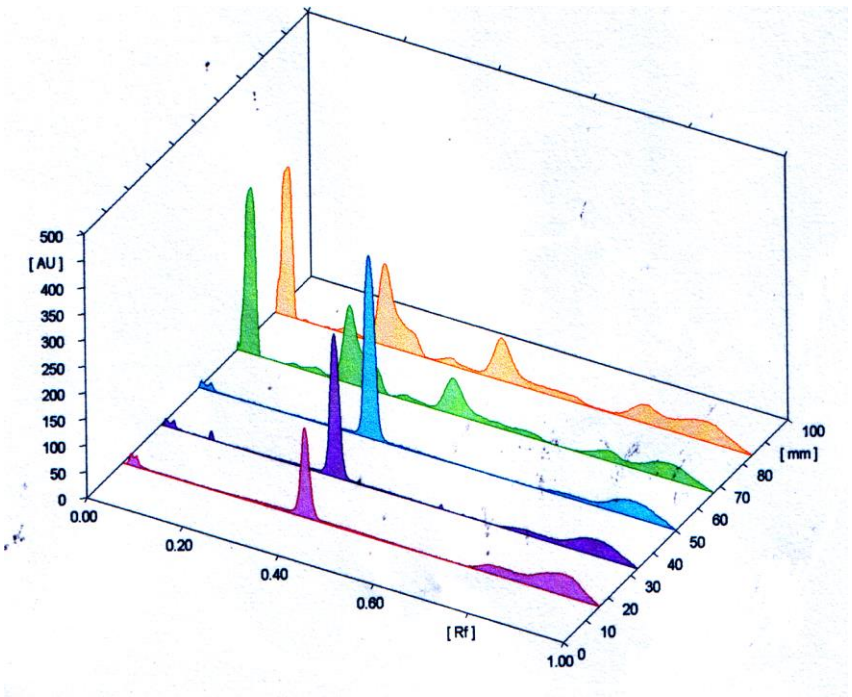

Figure 5. Chromatoplate spatial representation

Figure 5 shows the chromatoplate assessment at 318 nm wave length. In this figure the five bands on the chromatoplate can be seen in space as well as the location of resveratrol at *Rf*=0.33-0.38.

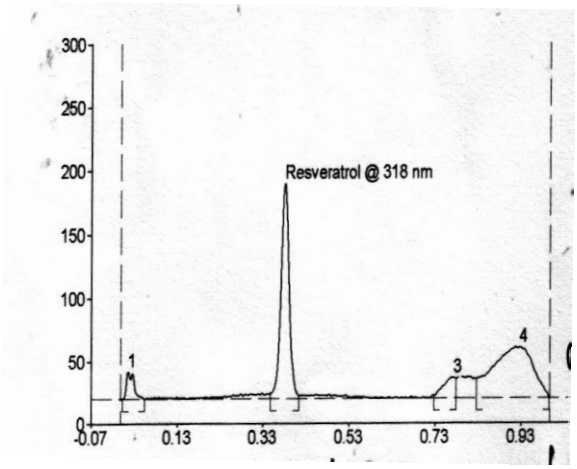

Figure 6. Standard 1 quantity, depending on peak height

Table 5

No.	*Start RF*	*Start Height*	*Max Rf*	*Max Height*	*Max %*	*End Rf*	*End Height*	*Area*	*Area%*	*Assigned substance*
0	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
1	0.00	0.2	0.02	22.2	8.91	0.06	0.3	326.2	4.85	Unknown
2	0.35	4.3	0.38	169.8	68.05	0.42	2.8	2755.9	40.95	Resveratrol
3	0.73	2.7	0.78	16.8	6.72	0.78	16.0	413.1	6.14	Unknown
4	0.83	16.0	0.93	40.7	16.32	1.00	0.5	3234.8	48.07	Unknown

Thus, for band 1, as shown in Table 5 and Figure 6, respectively, resveratrol in Standard 1 is located at the Rf within 0.35 nm start 0.38 nm maximum and ends at 0.429.

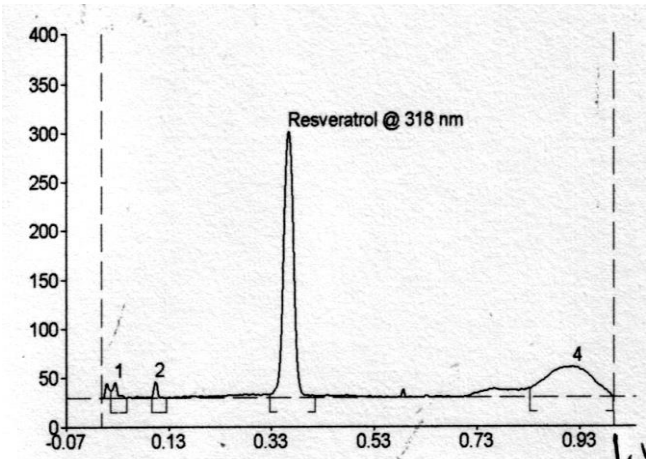

Figure 7. Standard 2 quantity depending on peak height

Table 6

Nr.crt	*Start RF*	*Start Height*	*Max Rf*	*Max Height*	*Max %*	*End Rf*	*End Height*	*Area*	*Area%*	*Assigned substance*
0	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
1	0.02	7.9	0.03	15.7	4.68	0.05	0.4	141.1	1.98	Unknown
2	0.10	0.5	0.11	16.5	4.94	0.13	0.4	91.0	1.28	Unknown
3	0.33	3.8	0.37	271.9	81.15	0.42	1.9	4524.0	63.42	Resveratrol
4	0.84	8.9	0.92	30.9	9.23	1.00	0.2	2377.9	33.33	Unknown

Band 2 represents standard 2 where standard 0.3µl was applied. Resveratrol is located, as shown in Figure 7 and Table 6, respectively, exactly at the same Rf ca as in the standard 1 case.

Band 3 on the chromatoplate represents standard 3 with 0.4 μl applied. Resveratrol, peak 3, as shown in graphic representation, i.e. Figure 8, Table 7, is located at the same Rf. The resveratrol peak height and area increases proportionally with the standard quantity applied. Band 1-2755.9, band 2 -4524.0, band 3 – 6408.8. Peak height: band 1=169.8 mm; band 2=271.9 mm; band 3 =346.3mm, and peak area: band 1=2755.92; band 2=452,404; band 3=6408.78.

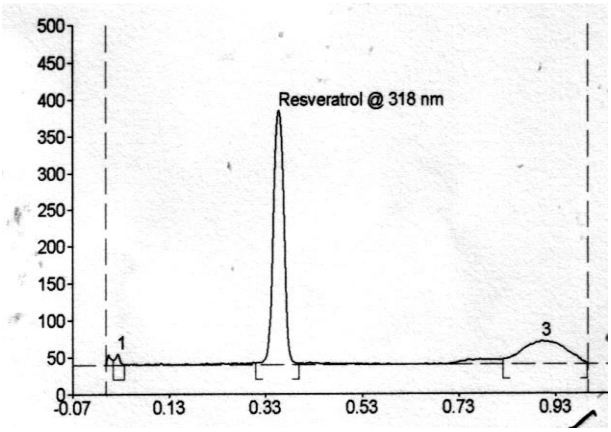

Figure 8. Standard 3 quantity depending on the peak height

Table 7

Nr.crt	*Start RF*	*Start Height*	*Max Rf*	*Max Height*	*Max %*	*End Rf*	*End Height*	*Area*	*Area%*	*Assigned substance*
0	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
1	0.02	7.5	0.03	15.3	3.89	0.04	1.1	136.5	1.52	Unknown
2	0.31	2.9	0.36	346.3	88.14	0.40	2.2	6408.8	71.32	Resveratrol
3	0.82	6.9	0.91	31.3	7.97	1.00	0.7	2440.1	27.16	Unknown

Band 5 on the chromatoplate represents the wine sample applied. In Figure 9 and Table 8, respectively, resveratrol peak 3 can be noticed to be located at Rf – start 0.33 – Rf-maximum 0.37 and ends at Rf=0,42. Still in this table, it can be noticed that peak area 5 is of 413.5 representing 2.22% of the total peak areas.

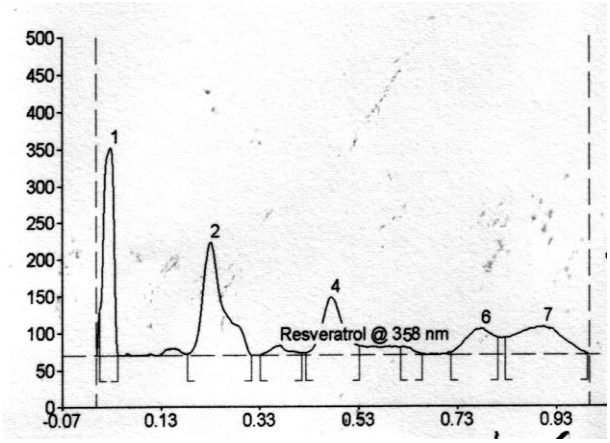

Figure 9. Sample Resveratrol depending on height

Table 8

No.	*Start RF*	*Start Height*	*Max Rf*	*Max Height*	*Max %*	*End Rf*	*End Height*	*Area*	*Area%*	*Assigned substance*
0	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
1	0.01	63.1	0.03	282.9	46.04	0.04	1.5	4983.1	26.73	Unknown
2	0.18	2.8	0.23	153.8	25.03	0.32	0.3	5445.8	29.22	Unknown
3	0.33	0.8	0.37	13.2	2.15	0.42	3.1	413.5	2.22	Resveratrol
4	0.42	3.8	0.48	79.2	12.90	0.53	12.6	2835.4	15.21	Unknown
5	0.62	10.6	0.62	11.3	1.83	0.66	1.2	220.8	1.18	Unknown
6	0.72	3.3	0.78	35.8	5.83	0.81	23.5	1637.4	8.78	Unknown
7	0.83	23.2	0.91	38.2	6.22	1.00	2.0	3104.0	16.65	Unknown

Assessing each band sequences

Table 9 shows the resveratrol sequences on each band in Tables 5, 6, 7, and 8. Rf, the maximum height of resveratrol peaks, the maximum area of resveratrol peaks, and the sample quantity used.

The graphic representation of the simple quantity depending on resveratrol peak height, Figure 10, and the sample quantity depending of peak areas, Figure 11, reveal a linear curve regression against the peak height and against the peak area: Y=-3.355+0.5356* X; r=0.99732 sdv=3.49

Y = -931.4+11.06* X; r=0.99935 sdv =2.03

Table 9

No	*Track*	*Rf*	*Amount*	*height*	*X(calc)*	*Area*	*X(calc)*	*Sample*
0	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*
1	1	0.38	330.00 ng	169.76	-	2755.92	-	-
2	2	0.37	500.00 ng	271.91	-	4524.04	-	-
3	3	0.36	660.00 ng	346.27	-	6408.78	-	-
5	5	0.37	-	-	30.98 ng	-	121.57	Red wine

The resveratrol found and calculated in red wine is 30.98 ng as compared to peak height and 121.57 ng against the peak area.

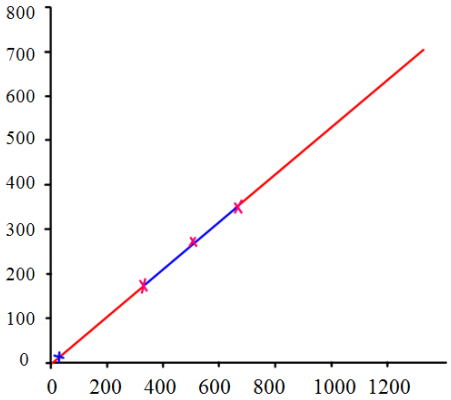

Figure 10 Standard quantity depending on peak height

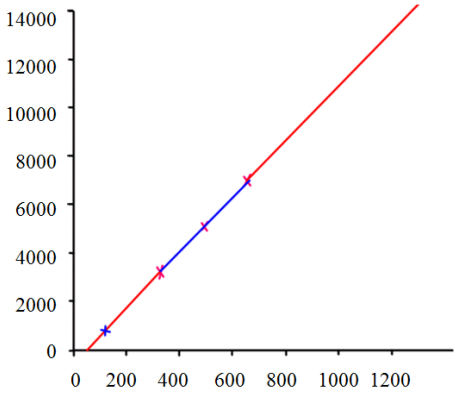

Figure 11 Standard quantity depending on peak area

Conclusions

The Tutova wine analysis revealed that it does not contain heavy metals, but it contains large amounts of K, Ca, and Fe. All the other metals are below legal limits.

Anthocyans and proanthocyans are within the limits set by wine quality regulations.

There is a significant quantity of vitamin C, hence its remarkable antioxidant activity, i.e. 77.63%.

In the wine under study, even after the age of one year, there is some 2.5 mg/l resveratrol, which allowed out to infer that the resveratrol content is higher in fresh wine.

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*** *Farmacopeea Romana*, Editia a X – a, Editura Medicala, Bucuresti, 1998, IX.C. 15, 18, 22, pg. 987,1026

*** Metoda elaborata si validata de laboratoarele de cercetare PlantaVorel Piatra-Neamt.

*** Metoda elaborata de UMF Iasi.

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Vin - http://www.scribd.com/doc/22962562/Proiectarea-Unei-Sectii-Pentru-Obtinerea-Vinurilor-Spumoase

FRUIT VARIETIES BREEDING IN ROMANIA: FROM THE BEGINNING TO PRESENT

Mihail COMAN[1], Madalina MILITARU[1], Madalina BUTAC[1]

Abstract. The paper presents objectives and results of Romanian breeding program, developed at the main fruit species. Based on a valuable tradition with old practical results, on different biological material, collected and preserved over the years in genetic resources, breeding of fruit varieties continues to improve the production and fruit quality, having regard to demands of fruit market and processing.

Key words: breeding, quality, consumer demand.

In Romania, fruit species breeding program initiated in 1948 by professor Nicolae Constantinescu, has three distinct periodes: 1950 to 1970, 1971 to 1999 and 2000 to present [6].

The periode I (1950 – 1970) began with organization of Research Stations Voinesti, Bistrita and Cluj, where some collections and field trials of the main fruit species were estalished. In this period, the assortment included old foreign varieties and local selections. The objectives were: introducing the world valuable varieties to establish the most suitable ones for the ecological conditions throughout the country; breeding new autochtonous cvs. to be competitive with the best ones spread all over the world, both for productivity and fruit quality; clonal selection of autochtonous and foreign varieties recently or formerly spread in various growing areas, in order to maintain their productive and biological potential [3].

The Research Institute for Fruit Growing Pitesti, established in 1967 has represented an important step in the development of breeding programs for all fruit species, including berries [7].

A special importance was granted to enrich fruit collections with local varieties, wild species and foreign varieties, to be able to supply the gene sources for the breeding program [1].

The results of the breeding program occurred beginning with 1970, by introduction in the "Romanian official list for propagation" of the first varieties (Table 1):

- apple: 'Aromat de vara', 'Rosu de Cluj', 'Frumos de Voinesti', 'Declicios de Voinesti';
- pear: 'Aromata de Bistrita', 'Timpurii de Dambovita', 'Napoca', 'Untoasa de Geoagiu', 'Aniversare', 'Republica';

[1] Research Institute for Fruit Growing Piteşti, Romania

- plum: ‘Tuleu timpuriu’, ‘Superb’, ‘Tuleu dulce’, ‘Gras ameliorat’, ‘Vinete romanesti 300’;
- sweet cherry: ‘Negre de Bistrita’ and ‘Uriase de Bistrita’
- sour cherry: ‘Timpurii de Cluj’, ‘Crisana 2’, ‘Mocanesti 16’;
- peach: ‘Frumos de Baneasa’, ‘Miorita’, ‘Bucuresti’, ‘Delicios’, ‘Flacăra’.

During the period II (1971 – 1999) the breeding work was mainly emphasized on studying the varieties in the field trials for comparison of new Romanian varieties and promising selections with the best foreign varieties, extention in production of the best cvs. and zoning of the fruit species and varieties, depending on environmental factors and fruit destination.

For the apple breeding, RSFG Voinesti, RSFG Bistrita and RIFG Pitesti, started to collaborate with Rutgers University (USA) using as genitors *Malus floribunda* 821 and ‘Prima’ for scab resistance, *M. Kaido, M. zumi* for mildew resistance and for quality ‘Golden Delicious’, ‘Parmain d'or’, ‘Jonathan’, ‘Cretesc’, ‘Patul’, ‘Starking Delicious’. Beginning 1983, new Romanian varieties with disease resistance and quality were registered and introduced in production [1].

For pear, the breeding work carried on RIFG Pitesti, RSFG Cluj and RSFG Voinesti, and 11 varieties were obtained having different ripening season [5].

For breeding quince, clonal selection of Bereczki cv. was used, and ‘Aurii’, ‘Aromate’ and ‘Moldovenesti’ cvs., with high production have been obtained.

The plum breeding work started at RIFG Pitesti, RSFG Valcea and RSFG Voinesti having as major objective improving of the old autochtonous cultivars ‘Tuleu gras’, ‘Grase romanesti’ and ‘Vinete romanesti’ cvs., and 18 new plum autochtonous varieties were registered [2].

Peach and apricot, breeding held at RSFG Constanta and RSFG Baneasa having as main goals the late blooming and fruit quality, resulting 18 new apricot varieties and 8 peach varieties.

For sweet cherry the breeding work were carried on at RSFG Bistrita, RSFG Iasi and RIFG Pitesti, aiming to earliness of the varieties, fruit firmness, low vigour and resistance to *Blumeriella jaapii*. Some varieties registered were scored for low vigor (‘Cerna’), disease resistance (‘Colina’, ‘Izverna’) and high nutritional content [6].

Breeding of sour cherry based on clonal selection carried on old ‘Mocăneşti’ and ‘Crisana’ cvs. and crossings for self fertility and high productivity, resistance to *Monilia* sp. and *Blumeriella jaapii,* fruit size and mechanical harvesting. 13 varieties were registered. Clonal selection of walnut carried on at RSFG Geoagiu, RSFG Tg. Jiu, RSFG Iasi and RSFG Valcea and a significant contributions have been made by recording a number of 21 varieties [9].

Clonal selection of chestnut was the concern of RSFG Baia Mare, by selection done in the wild populations, resulting seven genotypes, with appropriate quality for consumers requirements [9].

Hazelnut breeding has been made exclusively to RSFG Valcea, using the inter-specific hybridization, and recording 3 new varieties [9].

Berries breeding have been made at RSFG Cluj and RIFG Pitesti, paying attention to establish of genetic resources, using intra and interspecific hybridization, and clonal selection among the local biotypes. They were introduced 8 currant, 3 goosberry, 2 raspberry, 3 blueberry, 4 elderberry, 2 rosehip, 1 seabuckthorn and 6 strawberry cvs. [8].

Table 1. Fruit varieties released during 1971-1999

Species	No. of registered cvs.	Spread in production
Apple	22	Pionier, Generos, Romus 3, Romus 4, Ciprian, Auriu de Bistrita
Pear	11	Napoca, Trivale, Daciana, Monica, Euras
Quince	3	Aromate, Aurii, Moldovenesti
Plum	18	Centenar, Silvia, Carpatin, Tita, Record, Pescarus
Apricot	18	Rosii de Baneasa, Favorit, Dacia, Excelsior, Comandor, Mamaia, Selena
Peach	8	Victoria, Congres, Triumf, Superba de toamna
Sweet cherry	24	Cerna, Izverna, Ponoare, Daria, Amar de Maxut
Sour cherry	13	Tarina, Dropia, Nana, Ilva, Timpurii de Pitesti, Timpurii de Osoi
Walnut	21	Jupanesti, Sibisel, Geoagiu 65
Chestnut	7	Iza, Mara, Hobita
Almond	2	Marculesti
Hazelnut	3	Cozia, Valcea 22
Currant	8	Record, Rosu timpuriu, Perla neagra
Gooseberry	3	Somes, Zenit
Raspberry	2	Citria, Ruvi
Elderberry	4	Ina, Bradet, Flora
Seabuckthorn	1	Moldova
Blueberry	3	Azur, Augusta, Safir
Strawberry	6	Premial, Coral, Magic
Total	167	

The objectives of the fruit breeding in the last 10 years were similar to the ones from other European countries, and aiming at: releasing new varieties with fruit quality (texture, flavour, size and commercial aspects), good storage capacity, resistance to diseases and pests, by use of the genetic resources collected and preserved in collections, and by improving the selection technology of hybrid material, in addition to shorten the period for obtaining a new variety (Table 2 and Table 3).

Table 2. Present objectives of fruit breeding

Species	**Objectives**
Apple	• fruit quality • *Venturia inaequalis* resistance • spur fructification
Pear	• *Erwinia amylovora* and *Psylla* sp. tolerance • winter cultivars and quality
Plum	• fruit quality • tolerance/resistance to PPV • self-fertility
Sweet and sour cherry	• fruit size • low vigour • self-fertility; tolerance to diseases (*Blumeriella jaapii*, *Monilia* sp.)
Apricot	• frost resistance • early and late ripening
Peach and nectarin	• fruit quality • *Taphrina deformans* tolerance
Walnut	• lateral fructification • precocity • low vigour
Currant	• disease resistance • large fruit; high content in C vitamin • simultaneous ripening
Raspberry and blackberry	• resistance to frost and diseases • fruit size • resistance to transport
Blueberry	• fruit quality • early and late ripening
Strawberry	• *Botrytis* sp. and *Phythophtora* sp. tolerance • fruit size, firmness and flavour

Table 3. Fruit cvs. registered during 2000 to present

No.	Cultivar	Genitors	Year of registration	Maintainer
Apple				
1	Starkprim	Prima x Starkrimson	2000	RSFG Bistriţa
2	Jonaprim	Prima x Jonathan	2000	RSFG Bistriţa
3	Bistriţean	Starkrimson x Prima	2002	RSFG Bistriţa
4	Salva	Golden Delicious x Prima	2002	RSFG Bistriţa
5	Goldprim	Golden Delicious x Prima	2003	RSFG Bistriţa
6	Romus 5	Romus 3 x Prima	2003	RIFG Piteşti
7	Rebra	Florina x Idared	2003	RIFG Piteşti
8	Redix	Goldspur x Prima o.p.	2004	RSFG Voineşti
9	Auriu de Cluj	Cj X-5-52 x Mutsu	2005	RSFG Cluj
10	Estival	NJR 55 X Sir Prize	2005	RSFG Cluj
11	Precoce de Ardeal	X-5-71 (Feleac x Sir Prize) x Prima	2005	RSFG Cluj
12	Productiv de Cluj	Cluj III-VI-5-26 x NJ 46	2005	RSFG Cluj
13	Iris	Prima o.pol., gamma iradiation of seeds	2005	RSFG Voineşti
14	Dany	Jonathan iradiat P32 x Prima	2005	RSFG Bistriţa
15	Alex	Golden D. x BN 33/39	2005	RSFG Bistriţa
16	Doina	Jonathan x Prima	2005	RSFG Bistriţa
17	Nicol	Wijcik X Pionier	2005	RIFG Piteşti
18	Luca	Champion x Prima	2006	RSFG Voineşti
19	Irisem	gamma iradiation pepins Prima o.p.	2006	RSFG Voineşti
20	Colmar	Mc Intosh Wijcik x Florina	2006	RIFG Piteşti
21	Colonade	Pionier x Mc Intosh Wijcik	2007	RIFG Piteşti
22	Real	Prima o.pol., gamma iradiation of seeds	2007	RSFG Voineşti
23	Remar	-	2008	RSFG Voineşti
24	Rustic	Florina x Pionier	2009	RIFG Piteşti
25	Inedit	-	2009	RSFG Voineşti
26	Voinicel	-	2009	RSFG Voineşti
27	Dacian	-	2009	RSFG Voineşti
28	Silvan	Clar alb x Richared	2010	RSFG Cluj
29	Somesan (Aurapple)	Clar alb x Richared	2010	RSFG Cluj
30	Stefano	London Pepping o.p	2010	RSFG Cluj
Pear				
31	Virgiliu hibernal	Passe Crasanne x Comtesse de Paris	2000	RSFG Cluj
32	Jubileu 50	Napoca x Beurre precoce Morettini	2003	RSFG Cluj

33	Milenium	(Josephine de Malines x Dr. Lucius) x Comtesse de Paris	2003	RSFG Cluj
34	Corina	Passe Crassane x (B.C. *P. serotina* x Olivier de Serres) x D. du Comice	2003	RSFG Voineşti
35	Orizont	[(*P. serotina* x Olivier de Serres) x O. de Serres] x Josephine de Malines	2003	RSFG Voineşti
36	Ervina	(*P. serotina* x Williams) x Napoca	2003	RIFG Piteşti
37	Roşioară de Cluj	Max Red Bartlet x Beurre Giffard	2005	RSFG Cluj
38	Tudor	[(*P. serotina* x Doyenne d'hiver) x Passe Crassanne] x TN 30-44 Angers	2007	RSFG Voineşti
39	Arvena	Triomphe de Vienne o.p.	2007	RSFG Cluj
40	Paramis	Monica x Passe Crassane	2008	RIFG Piteşti
41	Meda	ElitaVoinesti 53-15-3 x Contesa de Paris	2009	RSFG Cluj
42	Latina	Elita Cj 20-4-3 x Contesa de Paris	2009	RSFG Cluj
43	Romcor	[Passe Crasane x (*P. serotina* x O. de Serres)] x D. du Comice	2009	RSFG Voineşti
44	Cristal	[(Roşior pietros x D. d'hiver) x D. d'hiver] x Beurre Hardy	2009	RSFG Voineşti
45	Paradise	H 26-67-73 P x Păstrăvioare	2010	RIFG Piteşti
46	Paradox	Monica x Păstrăvioare	2010	RIFG Piteşti
47	Capriciosa	Cj 16-2-9 x Napoca	2010	RSFG Cluj
48	Primadona	Napoca x Red Williams	2010	RSFG Cluj
49	Adria	Clapp's Favorite x Napoca	2010	RSFG Cluj
Plum				
50	Andreea	-	2000	RSFG Vâlcea
51	Iulia	Tuleu Gras X R. Althan	2002	RSFG Bistriţa
52	Delia	Vânăt de Italia X Anna Spath	2002	RSFG Bistriţa
53	Ivan	Tuleu Gras X Vânăt de Italia	2003	RSFG Bistriţa,
54	Jubileu 50	Tuleu Gras X De Bistriţa	2003	RSFG Bistriţa,
55	Agent	-	2004	RIFG Pitsti
56	Roman	Tuleu Gras X Early Rivers	2004	RIFG Piteşti
57	Doina	Anna Spath X Renclod Althan	2004	RSFG Bistriţa
58	Dani	Tuleu Gras X Grase româneşti	2004	RSFG Bistriţa
59	Geta	-	2004	RSFG Bistriţa
60	Matilda	Anna Spath X Agen irradiation Co^{60}	2004	RSFG Bistriţa

61	Romaner	Tuleu Gras X Renclod Althan	2005	RIFG Piteşti
62	Zamfira	Anna Spath X Renclod Althan	2005	RSFG Bistriţa
63	Elena	Tuleu Gras X Stanley	2005	RSFG Bistriţa
64	Alutus	-	2010	RSFG Vâlcea,
Apricot				
65	Rareş	Băneasa 12P6 X NJA 13	2002	RSFG Băneasa
66	Carmela	Farmigdale X NJA 20	2002	RSFG Băneasa
67	Viorica	Băneasa 3/9 X NJA 20	2002	RSFG Băneasa
68	Valeria	Tivoli X Timpurii de Chişinău	2003	RSFG Băneasa
69	Nicuşor	B21/38 X C4R8T122	2003	RSFG Băneasa
70	Adina	S. pol. Umberto	2003	RSFG Băneasa
71	Auraş	Sam nr.1 X Mari de Cenad	2003	RSFG Constanţa
72	Cristal	Sam nr.1 X Mari de Cenad	2003	RSFG Constanţa
73	Danubiu	Sam nr.1 X Mari de Cenad	2003	RSFG Constanţa
74	Fortuna	Sam nr. 1 x Mari de Cenad	2004	RSFG Constanţa
75	Amiral	Mari de Cenad x CR 24-12	2004	RSFG Constanţa
76	Orizont	Mari de Cenad X CR 24-12	2004	RSFG Constanţa
77	Augustin	Mărculeşti 9/5 X 18/4	2004	RSFG Constanţa
78	Andrei	-	2006	RSFG Băneasa
79	Alexandru	-	2006	RSFG Băneasa
80	Monica	Băneasa 11-13 x Trandafiriu	2006	RSFG Bihor
81	Bihoreana	Băneasa 11-13 x Skana	2006	RSFG Bihor
82	Iulia	-	2006	RSFG Bihor
83	Ioana	-	2006	RSFG Bihor
84	Ceres	NJA 17 x R9P53	2007	RSFG Constanţa
85	Euxin	R30P62 x R41P62	2007	RSFG Constanţa
86	Histria	Worley's peach x Sulmona	2007	RSFG Constanţa
Peach				
87	Cecilia	2,44-5P3 x Silver Prolific	2000	RSFG Constanţa
88	Puiu	S. pol. R.18P4-P	2000	RSFG Constanţa,
89	Liviu (N)	6,65-120P12 X 25.11.68P1	2000	RSFG Constanţa
90	Melania (N)	1,47-13P7 X H2511-68P3	2000	RSFG Constanţa
91	Catherine	S. pol. Catherine	2001	RSFG Constanţa
92	Raluca	F2 hybrid	2001	RSFG Constanţa
93	Costin (N)	-	2002	RSFG Constanţa
94	Florin	Stark Saturn sel. VT	2002	RSFG Constanţa
95	Filip	C2R6T178 x NJF2	2002	RSFG Constanţa
96	Alexia	Flacăra x Marygold	2002	RSFG Băneasa
97	Amalia	Roubidoux X Flacăra	2002	RSFG Băneasa
98	Antonia	Elberta X I. H. Halle	2002	RSFG Băneasa
99	Tina (N)	Crimsongold X NJN21	2003	RSFG Băneasa
100	Mihaela (N)	Crimsongold X Ark125	2003	RSFG Băneasa
101	Eugen	I.H. Halle X Mayflower	2003	RSFG Băneasa
102	Dida	Flacăra X HB9-35	2003	RSFG Băneasa
103	Năică (N)	H1.47 – 13 P6 x H251168 P3	2003	RSFG Constanţa

104	Valerica	-	2003	RSFG Constanţa
105	Oradea 11 (N)	Stark sumbirst dwarf x Colins	2006	RSFG Bihor
106	Oradea 19	Stark sumburst dwarf xFillette	2006	RSFG Bihor
107	Oradea 34	Stark sumburst dwarf x Redhaven	2006	RSFG Bihor
108	Oradea 40	Stark sumburst dwarf x Colins	2006	RSFG Bihor
109	Alex	-	2006	RSFG Băneasa
110	Herăstrău	-	2006	RSFG Băneasa
Almond				
111	Sandi	Primorski x Tuono	2006	RSFG Bihor
112	Ana	Ardechoise x H1/9 – 1fa	2006	RSFG Bihor
113	Sabina	Ardechoise x Pomorie	2006	RSFG Bihor
114	Viola	Ardechoise x Pomorie	2006	RSFG Bihor
115	April	Primorski x [(Preanâi x Crâmsky)]	2006	RSFG Bihor
Sweet cherry				
116	Cătălina	Van X Boambe de Cotnari	2001	RSFG Iaşi
117	Golia	Van X Boambe de Cotnari	2001	RSFG Iaşi
118	Marina	Boambe de Cotnari X HC 23/31	2001	RSFG Iaşi
119	Superb	Boambe de Cotnari X Thurn Taxis	2002	RIFG Piteşti
120	Bucium	Van x Boambe de Cotnari	2006	RSFG Iaşi
121	Iaşirom	Van x Boambe de Cotnari	2006	RSFG Iaşi
122	Ştefan	Van x Boambe de Cotnari	2006	RSFG Iaşi
123	Tereza	Van x Ebony	2006	RSFG Iaşi
124	Sublim	Muncheberger fruhe X Big. Moreau	2006	RIFG Piteşti
125	George	Cireşe de Octombrie x Fromm	2007	RSFG Iaşi
126	Gloria	-	2009	RSFG Bistrita
127	Spectral	-	2009	RIFG Piteşti
128	Ivona	-	2009	RSFG Bistrita
Sour cherry				
129	Rival	Griot Moscovski x Nana	2004	RIFG Piteşti
130	Amanda	-	2005	RSFG Fălticeni
131	Stelar	-	2008	RIFG Piteşti
Walnut				
132	Valmit	Local population selection	2000	RSFG Vâlcea
133	Ovidiu	Local population selection	2001	RSFG Iaşi
134	Claudia	G4 X 44-430	2003	RSFG Geoagiu
135	Sibişel 252	Local population selection	2003	RSFG Geoagiu
136	Geoagiu 86	Local population selection	2003	RSFG Geoagiu
137	Ciprian	Sibişel 44 X Sibişel 4	2003	RSFG Geoagiu
138	Valstar	-	2010	RSFG Vâlcea

139	Valcris	-	2010	RSFG Vâlcea
140	Timval	-	2010	RSFG Vâlcea
141	Unival	-	2010	RSFG Vâlcea
Chestnut				
142	Romval	-	2010	RSFG Vâlcea
Currant				
143	Ronix	Tsema X Kantata 50	2000	RIFG Pitești
144	Deea	Tsema X Kantata 50	2000	RIFG Pitești
145	Record 35		2001	RSFG Fălticeni
146	Padina	5/24-77 X 2/50-79	2003	RIFG Pitești
147	Geo	Tsema X Kantata 50	2003	RIFG Pitești
Gooseberry				
148	Polin		2010	RIFG Pitești
149	Virens	Malahit o.pol.	2007	RIFG Pitești
150	Verda	Malahit o.pol.	2007	RIFG Pitești
Raspberry				
151	Star	Citria x Orss Seedling	2000	RIFG Pitesti
152	Opal	Babie Leta x Lylin	2003	RIFG Pitesti
153	Gustar	Heritage x Zewa H.	2003	RIFG Pitesti
Blackberry				
154	Felix	Willson x Early Thornfree	2001	RSFG Fălticeni
155	Orest	-	2005	RSFG Fălticeni
156	Dar 8	Darow o.pol.	2006	RIFG Pitești
157	Dar 24	Darow o.pol.	2006	RIFG Pitești
Blueberry				
158	Simultan	Spartan o.pol.	2001	RIFG Pitești
159	Delicia	Patriot o.pol.	2001	RIFG Pitești
160	Lax	Spartan o.pol.	2002	RIFG Pitești
161	Compact	Spartan o.pol.	2002	RIFG Pitești
Seabuckthorn				
162	Pitești 1	Wild population selection	2006	RIFG Pitesti
163	Pitești 2	Wild population selection	2006	RIFG Pitesti
Strawberry				
164	Roxana	Gorella X Red Gauntlet	2003	RSFG Satu Mare
165	Safir	Sunrise X Premial	2003	RSFG Satu Mare
166	Ralu	Pajaro X Premial	2003	RSFG Satu Mare
167	Delicios	Dana X Red Gauntlet	2003	RSFG Satu Mare
168	Viva	Addie X Red Gauntlet	2003	RSFG Satu Mare
169	Mara	Pajaro X Red Gauntlet	2003	RSFG Satu Mare
170	Floral	Red Gauntlet x Irvine	2004	RIFG Pitesti

For the next periode, the fruit breeding in Romania should go on taking into account of:

- old and valuable tradition in the field;large variability of wild and cultivated genotypes existing;
- relation quality – consumer demand, as a new concept;
- pollution reducing;
- consumer protection.

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INFLUENCE OF THE SOIL MANAGEMENT SYSTEM ON SOME CHEMICAL COMPONENTS IN 3 SOIL TYPES FROM A HIGH DENSITY APPLE ORCHARD

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Abstract. Among technological measures practiced in intensive orchards the soil management systems presents a special importance both because of modification of soil properties and because of their evident influence of trees behaviour. To quantify the effects of soil management system from an apple intensive orchard with the Starkrimson cultivar grafted on MM 106, on some soil chemical components, in the period 1985-2005, some investigations were done inside of Research Institute for Fruit Growing Pitesti, Romania. It was organized the following experimental scheme: A Factor, soil type, with 3 graduation; B Factor, soil management system, with two graduation on average on the two soil management systems and 0-60 cm soil depth, on the eutricombosol with colluvic characters, versus typical eutricombosol, the humus content was higher by 23%, the potassium content by 57%, the base exchange materials by 69% and hidrolytic acidity by 33%. On average on three soil types and 0-60 cm soil depth, maintenance of sod strips versus cultivated soil, determined an increase of humus content by 17% and of base status by 8%. Between the studied 8 soil chemical components significant correlations were established with a higher intensity on 0-20 cm soil depth.

Key words: humus, phosphorus, potassium, mowed sod strips

1. Introduction

Among the technological practices applied in the high density orchards, the soil management systems are particularly important both due to the modification of soil properties and also for the obvious influence on the trees behavior. The effects of the soil management systems on the soil chemical modification in the fruit orchards were reported in many works (Haynes, 1980; Haynes and Goh, 1980, 1980 a; Hogue and Nielsen, 1987; Merwin, 1991; Welker and Glenn, 1988; Merwin and Stilles, 1994, Lipecki and Berbec, 1997, Scribbs and Scroch, 1986, etc.).

The studies of the authors above – mentioned dealed generally with one type of soil found particularly on flat lands, the investigations taking a relatively short time. To sum up the effects of soil management systems for a longer period (20 years) on the chemical components some investigations on 3 soil types in a high density apple orchard located on a slope land were carried out (at the Research Institute for Fruit Growing Piteşti - Mărăcineni).

[1] Research Institute for Fruit Growing Piteşti - Mărăcineni

2. Material and method

The investigations were carried out in a high density apple orchard, situated on a hillside with a length of line on the greatest slope of 200 m and a slope of 6-12%. The trees were planted at 3.6 m between rows and 1.5 m between trees on the row. It was organized the following experimental scheme:

Factor A - soil type, with the following graduations: a_1 = eutricombosol with colluvic character (CE), a_2 = slightly eroded eutricombosol (SEE) a_3 = typical eutricombosol (TE). *Factor B* – soil management system between tree rows: b_1 = cultivated, performed by a fall plowing to 12-14 cm and repeated disking during the vegetation period, b_2 = 2.4 – 2.6, wide mowed sod strips performed by sowing of *Lolium perenne*. Soil samples were taken from each of the graduations of the experimental factors. Samples were collected on depths 0-20 cm, 20-40 cm, 40-60 cm. It was determined humus - %, phosphorus - ppm, potassium - ppm, pH, total exchangeable bases - me, hydrolytic acidity -me , cation exchange capacity - %, base status - %.

3. Results

3.1. Soil and management system influence on the values of chemical components analyzed (average values of graduation of A, B experimental factors).

3.1.1. Soil influence

On the average, for the two soil management systems and for the 3 sampling depths, the humus content in CE soil was higher by 22-23% versus to the value of the same characteristic in SEE and TE soils. Under the same conditions, the value of K content in CE soil was higher by 10% versus the value recorded in SEE soil and by 57% versus. the value of TE soil. Also, the value of hydrolytic acidity in CE soil was higher by 15% versus the value recorded in SEE soil and by 33% versus that recorded in TE soil.

Towards the above order, where the 3 soil types studied were classified, for the chemical components related to humus, K and hydrolytic acidity, contents for the other chemical components related to pH values, total exchange bases, cation exchange capacity and base status, the classification of the 3 soil types was differently. Therefore, on the average for the 2 soil management systems and 3 soil sampling depths, pH value of SEE soil was 2% higher versus. the values of CE and TE soils. At the same time, the value of total exchangeable bases recorded on SEE soil was higher by 6% than that of CE soil and by 79% than on TE soil. Similarly, the value of cation exchange capacity recorded on SEE soil was higher by 4% versus the value recorded on CE soil and by 52% versus that on TE soil. Also, the base status recorded on SEE soil was higher by 2% versus that on CE soil and by 36% versus that on TE soil.

In case of P, the classification of the 3 soil types studied was differently than that of the two groups of chemical component mentioned above. Thus, in case of P, on the average for the two soil management systems and 3 soil sampling depths, the highest value of this chemical components was recorded on TE soil (5.63%) which was 6% higher than that recorded on CE soil and by 14% than SEE soil.

Table 1. The influence of management system on some chemical components on three soil types in an intensive apple orchard (average values for graduations of A/B experimental factors)

Chemical component	Soil depth cm	Graduations of A/B experimental factors				
		a_1	a_2	a_3	b_1	b_2
1	0-20	2,165	2,370	3,045	2,25	2,803
	20-40	1,915	1,300	0,690	1,240	1,363
	40-60	1,305	0,745	0,630	0,850	0,937
2	0-20	5,75	7,75	8,90	8,21	6,72
	20-40	6,00	3,50	4,00	8,20	6,73
	40-60	4,25	3,50	4,0	3,67	4,17
3	0-20	153,0	156,8	121,3	150,0	137,4
	20-40	117,2	102,8	65,3	107,3	82,9
	40-60	146,4	119,2	79,4	117,5	112,5
4	0-20	4,98	5,08	4,83	4,98	4,95
	20-40	4,92	5,01	5,11	5,01	5,02
	40-60	5,02	6,12	4,98	5,09	4,99
5	0-20	11,70	13,50	7,40	10,27	11,47
	20-40	9,10	11,6	5,20	8,27	9,00
	40-60	16,80	14,80	9,70	15,87	11,67
6	0-20	6,54	5,73	6,23	5,49	6,85
	20-40	6,50	5,58	3,14	5,04	5,10
	40-60	6,61	5,82	5,42	6,19	5,70
7	0-20	16,18	18,80	13,93	16,47	16,14
	20-40	15,30	17,44	11,01	14,20	14,97
	40-60	22,90	20,34	12,20	19,92	17,05
8	0-20	72,90	71,29	53,24	66,10	71,10
	20-40	59,46	66,32	50,66	68,70	71,39
	40-60	73,46	72,55	50,66	48,39	54,65

Soil type: a_1 = eutricombosol with colluvic character (CE); a_2 = slightly eroded eutricombosol (SEE); a_3 = typical eutricombosol (TE). Factor B – soil management system between tree rows: b_1 = cultivated, performed by a fall plowing to 12-14 cm and repeated disking during the vegetation period, b_2 = 2.4 – 2.6, wide mowed sod strips, performed by sowing of *Lolium perenne*.

Chemical component: 1 = humus - %, 2 = phosphorus - ppm, 3 = potassium - ppm, 4 = pH, 5 = total exchangeable bases - me, 6 = hydrolytic acidity - me, 7 = cation exchange capacity - %, 8 = base status - %

3.1.2. Influence of soil management system

On the average, for the 3 soil types and 3 soil sampling depths, the soil management as sod strips between the tree rows versus its management as clean cultivation, determined a raise of humus content by 17%, of hydrolitic acidity by 6% and of base status by 8%. At the same time, the soil management as clean cultivation between the tree rows versus that of sod strips, determined a raise of P content by 14%, of K content by 13%, of pH values by 0.8%, of total exchangeable bases by 7% and of cation exchange capacity by 5% (table 1).

3.2. Influence of soil management systems on some chemical components per 3 soil types (interaction of A/B experimental factors)

3.2.1. Influence of soil on some chemical components within each of the 2 soil management systems

On the average, for 3 soil sampling depths, the differences between the extreme values recorded with the 3 soil types for 6 of 8 chemical components analyzed (P, K, ph, total exchangeable bases, hydrolytic acidity and cation exchange capacity) were higher by 15% in case of grass strips versus the clean cultivation management system.

In return, under the same conditions, the differences between the extreme values, for the 3 soil types showed that for 2 of 8 chemical components (humus content and base status) were higher by 6.8% in case of clean cultivation versus the grass trips management system (table 2).

3.2.2. Influence of the soil management systems on some chemical components within each of 3 soil types.

On the average, for 3 soil sampling depths, the values of humus content, hydrolytic acidity and base status were higher in case of sod strips versus the clean cultivation in 8 of 9 cases investigated, representing 89% of the number of these cases. The other 5 chemical properties recorded higher values in case of clean cultivation system versus the sod strips in 10 of 15 cases investigated, recording 66%.

Table 2. The influence of management system on some chemical properties on three soil types in an intensive apple orchard (interaction graduations of experimental factors A/B)

Chemical components	Soil depth cm	a_1		a_2		a_3	
		b_1	b_2	b_1	b_2	b_1	b_2
1	0-20	2,08	2,25	2,02	2,72	2,65	3,44
	20-40	1,79	2,04	1,24	1,36	0,69	0,69
	40-60	1,15	1,46	0,77	0,72	0,63	0,63
2	0-20	5,50	6,00	10,50	5,00	8,63	9,17
	20-40	6,00	6,00	4,00	3,00	5,00	5,00
	40-60	4,00	4,5	3,00	4,00	4,00	4,00
3	0-20	143,8	162,2	196,7	117,0	109,6	133,0
	20-40	124,8	109,5	117,9	87,8	79,3	51,3
	40-60	135,7	157,0	135,3	103,2	81,6	77,2
4	0-20	5,10	4,87	5,10	5,06	4,74	4,92
	20-40	4,94	4,90	4,98	5,04	5,11	5,11
	40-60	5,04	5,01	5,15	5,10	5,10	4,86
5	0-20	12,2	11,2	11,2	15,8	7,4	7,4
	20-40	8,6	9,6	11,0	12,2	5,2	5,2
	40-60	18,0	15,6	16,8	12,8	12,8	6,6
6	0-20	5,60	7,49	5,59	5,88	5,27	7,19
	20-40	6,11	6,89	5,88	5,27	3,14	3,14
	40-60	6,94	6,28	5,87	5,81	5,81	5,02
7	0-20	18,02	14,34	16,79	20,82	14,59	13,27
	20-40	14,71	15,88	16,88	18,01	11,01	11,01
	40-60	24,94	20,87	22,62	18,07	12,20	12,20
8	0-20	67,70	78,10	66,70	75,88	50,72	55,76
	20-40	58,46	60,45	65,16	67,47	47,23	54,09
	40-60	72,17	74,74	74,27	70,83	47,23	54,09

Soil type: a_1 = eutricombosol with colluvic character (CE); a_2 = slightly eroded eutricombosol (SEE); a_3 = typical eutricombosol (TE). Factor B – soil management system between tree rows: b_1 = cultivated, performed by a fall plowing to 12-14 cm and repeated disking during the vegetation period, b_2 = 2.4 – 2.6, wide mowed sod strips, performed by sowing of *Lolium perenne*.

Chemical component: 1 = humus - %, 2 = phosphorus - ppm, 3 = potassium - ppm, 4 = pH, 5 = total exchangeable bases - me, 6 = hydrolytic acidity - me, 7 = cation exchange capacity - %, 8 = base status - %

3.3. Influence of soil management systems on the deep distribution of some chemicals in soil

On the average, for the 3 soil, the distribution per depth of 8 chemical components was differently related to the soil management system. The data in table 3 show that the most obvious difference between the 2 soil management systems regarding the values of chemical components was recorded on 0-20 cm soil profile, where there are developed the most roots of the grass strips. Thus, the

humus content in the grass strips versus the clean cultivation was higher by 24.6% on 0-20 cm depth versus 17% recorded on 0-60 cm depth. On the other hand P content in the sod strips system versus clean cultivation was lower by 18.2% on 0-20 cm depth versus 12.3% on 0-60 cm depth. K content showed a similar tendency.

Table 3. Influence of soil management system on distribution by depth of some chemical components

Chemical Component	**Soil Depth -cm-**	**Soil Management System**		
		b_1	**b_2**	**b_2 versus b_1 (%)**
Humus %	0-20	2.25	2.803	124.6
	20-40	1.24	1.363	109.9
	40-60	0.85	0.937	110.3
	0-60	1.446	1.701	117.6
Phosphorus ppm	0-20	8.21	6.72	81.8
	20-40	8.20	6.73	82.1
	40-60	3.67	4.17	123.4
	0-60	6.69	5.87	87.7
Potassium ppm	0-20	150.0	137.4	91.6
	20-40	107.3	82.9	77.3
	40-60	117.5	112.5	95.7
	0-60	124.9	110.9	88.8

b_1 = cultivated, performed by a fall plowing to 12-14 cm and repeated disking during the vegetation period, b_2 = 2.4 – 2.6, wide mowed sod strips, performed by sowing of *Lolium perenne*.

3.4. Nature and intensity of correlations between some chemical components for 3 soil types, 2 soil management systems and 3 soil sampling depths

Table 4 shows that for 3 soil types, 2 soil management systems and 3 soil sampling depths, of the 8 chemical components studied, the highest number of significant correlations (6) was recorded with the characteristic of soil pH. That represented 86% of the total number of calculated correlations for this soil chemical characteristic. In the second place was the hydrolytic acidity with 5 significant correlations, representing 71% of the total number of calculated correlations. In the 3rd place, with 4 significant correlations, representing 57% of the total number of calculated correlations were 4 chemical characteristics (humus content, total exchangeable bases, cationic exchange capacity and base status). A lower number of significant correlations was recorded with K content (2) and P content (1).

Table 4. The nature and intensity of correlations between some chemical components for tree soil types, 2 soil management systems and tree soil sampling depths (0-20 cm; 20-40 cm;40-60 cm)

Chemical components	2	3	4	5	6	7	8
1	0,482*	0,722**	0,620**	NS	0,602**	NS	NS
2		NS	NS	NS	NS	NS	NS
3			0,505*	NS	NS	NS	NS
4				0,628**	0,671**	0,564*	0,663**
5					0,646**	0,978***	0,942***
6						0,655**	0,689**
7							0,840***

Chemical components: 1= Humus%; 2=pH; 3= phosphorus - ppm, 4 = potassium 5 = Total exchange bases (me), 6 = Hidrolitic acidity (me); 7 = Cation exchange capacity (%); 8 = Base status (%)

3.5. Influence of soil management systems on the nature and intensity of correlations between some chemicals components for 3 soil sampling depths

For the 3 soil types and 3 soil sampling depths, the highest number of significant correlations (10) among the 8 characteristic determined was recorded with the clean cultivation as soil management system. Thys number represented 36% of the total number of calculated correlations (table 5).

Table 5. The influence of soil management system as clean cultivation on the nature and intensity of correlations between some chemical components on three soil types and 3 soil sampling depths

Chemical components	2	3	4	5	6	7	8
1	NS	0,6417**	NS	NS	NS	NS	NS
2		NS	NS	NS	NS	NS	NS
3			NS	NS	NS	NS	NS
4				0,717*	NS	0,673*	0,753*
5					0,819**	0,992***	0,973***
6						0,808**	0,773*
7							0,926***

Chemical components: 1= Humus%; 2 = phosphorus - ppm, 3 = potassium ppm; 5= Total exchange bases (me), 6 = Hidrolitic acidity (me); 7 = Cation exchange capacity (%); 8 = Base status (%)

Under the same conditions, in case of soil management system as sod strips, the number of significant correlations was 8, representing 29% of the total number of calculated correlations (table 6).

Table 6. The influence of soil mowed sod strips system on the nature and intensity of correlations between some chemical components on three soil types and 3 soil sampling depths

Chemical components	**2**	**3**	**4**	**5**	**6**	**7**	**8**
1	NS	0,613*	0,4894*	NS	0,561*	NS	NS
2		NS	NS	NS	NS	NS	NS
3			NS	NS	NS	NS	NS
4				NS	0,6499*	NS	0,4517*
5					NS	0,9434***	0,942***
6						NS	NS
7							0,825**

Chemical components: 1 = Humus%; 2 = phosphorus – ppm, 3 = potassium ppm; 5= Total exchange bases (me), 6 = Hidrolitic acidity (me); 7 = Cation exchange capacity (%); 8=Base status (%)

3.6. Influence of soil sampling depths on the nature and intensity of correlations intensity for 3 soil types and 2 management systems

For the 3 soil types and 2 management systems, among the values of soil chemical characteristics determined on 0-20 cm, only 2 significant correlations were recorded, represented 7% of the total number of calculated correlations (table 7).

Table 7. The influence of management system on nature and intensity of correlations between some chemical components on three soil types (values for 0-20 cm soil depth)

Chemical components	**2**	**3**	**4**	**5**	**6**	**7**	**8**
1	NS	NS	NS	NS	NS	NS	NS
2		NS	NS	NS	NS	NS	NS
3			NS	NS	NS	NS	NS
4				NS	NS	NS	NS
5					NS	0,902*	0,881*
6						NS	NS
7							NS

Chemical components: 1= Humus%; 2 = phosphorus - ppm, 3 = potassium ppm; 5 = Total exchange bases (me), 6 = Hidrolitic acidity (me); 7 = Cation exchange capacity (%); 8 = Base status (%)

At the same time, among the values of 8 soil chemical characteristic determined on 20-40 cm depth, 12 significant correlations were recorded, represented 43% of the total number of calculated correlations (table 8).

Table 8. The influence of management system on nature and intensity of correlations between some chemical components on three soil types (values for 20-40 cm soil depth)

Chemical components	**2**	**3**	**4**	**5**	**6**	**7**	**8**
1	0,958**	NS	0,811*	NS	0,974***	NS	NS
2		NS	0,895*	NS	0,971***	NS	NS
3			NS	NS	NS	NS	NS
4				NS	0,864*	NS	NS
5					0,864*	0,998*	0,999*
6						0,868*	0,853*
7							0,997***

Chemical components: 1= Humus%; 2 = phosphorus - ppm, 3 = potassium ppm; 5 = Total exchange bases (me), 6 = Hidrolitic acidity (me); 7 = Cation exchange capacity (%); 8 = Base status (%)

4. Discussion

It is well known that the erosion of the soil superior horizons, generally brings about a decrease in the content of the major chemical components of soil both on the arable lands (Moţoc, 1963, Iancu, 1968) and also in the fruit orchards ((Popa, and Bor, 1975, Iancu, 1967, Iancu et all, 1967, Neamţu 1980). Data regarding the humus and K contents as well as the values of hydrolytic acidity mentioned in this paper proved this general tendency, especially for 20-40 cm and 40-60 cm soil depths. For 0-20 cm depth, the values of humus and K contents recorded on CE soil were lower than those recorded on SEE soil, probably because the soil layer on 0-20 cm depth of CE soil originated of the last eroded materials from the slope. Moreover, for the values of the other chemical components described in this paper (total exchangeable bases, pH values, cationic exchange capacity, base status) recorded on 0-60 cm depth of CE soil were lower versus those recorded on SEE soil. Regarding the influence of soil management on the values of its chemical components, the data above mentioned showed that in case of sod strips, the values of humus content, hydrolytic acidity and base status were higher than those with clean cultivation. Regarding the organic matter in soil (Haynes, 1980) it is reported that in the untiled soils, the highest content of organic matter is found in the superficial soil layers and it is gradually decreased with the depth increase. By maintaining the sod in the orchard this tendency is amplified due to organic matter result from grass growing. An increase of the organic matter content in soil as a results of grass growing was also reported by Greenhan (1983) quated by Hogue

and Nielsen (1987). The greatest increase of organic matter content is mainly seen on the first 5 cm from soil surface but due to disintegration of grass roots, this increase, rather lower, can be observed on the whole depth explored by roots. These effects can be obviously in this paper, the data showing that in the sod strips system versus to the tilled soil, the increase of the organic matter content in soil was observed even on 40-60 cm depth. As Greenham (1965) reported (quoted by Hogue and Nielsen 1987), the soil managed as sod versus the clean cultivation managed by tilling does not seem to determine a raise of extractible P content. Data in this paper go to prove this conclusions. Nevertheless, the data reported by Deist et al (1973), quoted by Hogue and Nielsen (1987), showed the value of P content increased in the deeper layers of sod soil.

By disintegration of herbs results great K amounts, which according to some authors varied from 321 to 608 kg in New Zeeland (Haynes and Goh, 1980). Nevertheless, the data in this paper showed a lower content in case of sod strips system versus the clean cultivation. Hogue and Nielsen (1987), quoting different authors shows that the values of base status on the soils managed as sod strips versus the cultivated ones were higher especially due to a lower washing of Ca and Mg contents from the absorbent complex of sod soils. Data in this paper showed also higher values of the base status up to 60 cm depth in the sod strips system versus to clean cultivation. Comparatively to sod strips, the clean cultivation soil management system determined an obvious decrease of organic matter content in soil: Merwin, 1991; Welker and Glen, 1988, Merwin and Stiles, 1994. This decrease is mainly due to the increase, as a result of improving of mineralization speed, of organic matter in case of this management system owing to improvement of the soil physical and biological conditions for a short period. Also, by the soil tillage for maintaining the clean cultivation, the organic matter in the superficial layer is redistribute on the depth of tilled layer having greater chance of its decomposition. As Hogue and Nielsen (1987) reported, the effects of soil management as clean cultivation on some chemical components in soil (P, K, Ca, Mg) are less clear, suggesting that the soil management as clean cultivation may not be a major factor which can significantly alter the content of these elements.

Conclusions

On the average, for the 2 soil management systems and 3 soil sampling depths, the content of the 8 chemical components analyzed varied obviously among the 3 soil types analyzed.

On the average, for the 3 soil types and 3 soil sampling depths, soil management between the tree rows as sod strips, versus its management as clean cultivation, determined a raise in humus content by 17%, of hydraulic acidity by 6% and of base status by 8%. However, under the same conditions, the soil management as

clean cultivation versus the sod strips system determined an increase of P content by 14%, of K content by 13%, of pH values by 0,2%, of total exchangeable bases by 7% and of cationic exchange base by 5%.
On the average, for the 3 soil types, the most obvious difference between the 2 soil management systems regarding the value of chemical components was recorded on 0-20 cm depth.
Between the value of chemical component analyzed some positive correlations of various intensities related to the soil management system and soil sampling depth were recorded.

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FRUIT GROWING TECHNOLOGIES - PRESENT AND PERSPECTIVES

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Abstract. Romanian fruit growing, under financed in the last years, owns predominant old plantings, with low profit, and the establishment of modern new orchards is chaotic and insignificant, regardless on the most favorable soil and climatic areas and on local tradition in fruit growing. To enter and perform on the fruit market, the Romanian fruit growers need to establish new plantation types, using valuable nursery material, adapted to consumer's preferences. They need to apply in the new orchards, intensive fruit growing technologies, to provide constantly superior and high quality fruit yields. Orchards must produce earlier and sustained in order to generate an earlier return on investment and improve profitability. At Research Institute for Fruit Growing Pitesti Maracineni (RIFG), according the variety, the fruit productions obtained in experimental high density apple orchard of 3,077 trees x ha^{-1} (3.25 m x 1.0 m), were 19.3 up to 30.0 t x ha^{-1} in the second year after planting and in the third year from 29.7 to 38.5 t x ha^{-1}. This work goal is to present and recommend some orchard training systems, their appropriate technology and to highlights some results obtained at some apple cultivars in these types of orchards.

Key words: high density, apple orchard.

1. Introduction

In fruit growing, especially at European level, the intensive fruit production system tend to generalization, together with continuous supply all over the vegetation season of all positive interactions between the natural growing factors and physical, chemical and biological vegetation factors, well balanced and allocated at optimum levels as quantity and quality, by application of the advanced technological measures which also protect the orchards against the risk factors.

All these technological measures are applied in high density orchards, established with valuable biologic material, consisting in high productive cultivars, grafted on low vigor vegetative rootstocks, in order to obtain very high fruit yields on the surface unit and a superior economical efficiency.

The actual relief and pedo-climatic diversity of Romania offer favorable conditions to grow a large panel of fruit species, but the Global Climatic Changes bring into the actuality new criteria for durable zoning of fruit species and adequate fruit growing technologies as well [2].

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In this context, choosing the appropriate cultivar-rootstock combination, the needed technology for soil maintenance and fertilization and trees management, the choose of the most effective orchard phytoprotection program represent the major preoccupations for every fruit grower [3, 6, 8, 9].

As regard the fruit trees nutrition, Marangoni et all., 2001, shows that foliar feedings associated with fert-irrigations (nowadays used on a large scale in world fruit growing), insure in great measure the fruit trees needs for supplies, the soil fertilization is reducing and the fertilizers consumption as well.

The great densities of fruit trees on the surface unit, using low vigor vegetative rootstocks determines the diminution of the soil volume available for each fruit tree and determine the accentuation of the competition for nutrients and water, an exhaust of the soil explored by the roots and a higher trees dependence on the external supply with nutrients. On the other hand, if is applied constantly, the localized irrigation provide into the plants a sustained sap circuit, with the capacities to uptake the minerals especially for the roots developed in the soil volume supplied with water by irrigation [1, 7].

Present paper goal is to present some essential elements of fruit growing systems, modern technologies for apple and to support by the our researches results, the necessity to guide the Romanian fruit growers toward these technologies and orchard types which join in a happy manner the economical efficiency with the environment protection.

2. Material and method

In the spring of 2007, complex experience were set up in a super intensive orchard type, with planting distances 3.25 x 1.0 m (3,077 trees/ha). The experience was a polyfactorial one and included 36 variants (3 x 6 x 2) with 5 trees in replicate plot, disposed according to sub-divided plot method.

The experimental factors studied included:

A factor **- The Cultivar**: the biological material was represented by 'Jonagored', 'Fuji Kiku Clone 8' and 'Golden Delicious Clone B', grafted on ‘M9 T 337’;

B factor **- Fertilizers Dose**, applied concomitant with the irrigation water had 6 graduation:
b1 - untreated control, and annually fertilized with the following nutrients amounts:
b2 - N_{20}:$P2O5_{10}$:$K2O_{30}$:MgO_{10},
b3 - N_{40}:$P2O5_{20}$:$K2O_{60}$:MgO_{20},
b4 - N_{60}:$P2O5_{30}$:$K2O_{90}$:MgO_{30},
b5 - N_{80}:$P2O5_{40}$:$K2O_{120}$:MgO_{40},
b6 - N_{100}:$P2O5_{50}$:$K2O_{150}$:MgO_{50};

C *factor* - The pest and diseases management system - The aim was the comparative analysis of 2 pest and diseases management systems, 'standard' and 'integrate' using plant protection products with low impact on the environment and the users.

The experimental device is located on a plane ground situated on the second terrace of the Argeş River, the soil being brown eumezobasic, low podzolic and pseudogeic ones. As regard the experimental device soil texture is sandy-clay one with a good aeration and water holding capacity. Orchard ground management was with grass covered between the trees rows and cleared with herbicides on a 1.0 - 1.2 m wide strip, along the trees rows.

Daily meteo parameters (medium, high and low air temperature, daily air temperature amplitude, sun shine length, the rainfalls and pluviometric deficit - represented by the difference between the reference potential evapo-transpiration calculated with Penman-Monteith equations and rainfalls) were determined and stored at the RIFG Piteşti-Mărăcineni weather station located in the neighborhood of the experimental fields.

3. Results and discussions

3.1.Fruit growing systems evolution in Romania

Şefan N. and colab. (1983) referring to autochthonous intensivized orchards states that, although in the experiences carried out by the Romanian fruit growing research the performances were similar with the ones obtained abroad, „the driving" under the production conditions of the technologies established by the research activity, was realized with different performances according to the zones and production units.

The same authors opiates that among the major factors determining the productive potential diminution of these plantations type were: the orchards setup on improper grounds, incorrect execution or lack of canopy forming works, abandon of the summer prunings, insufficiency of resources, poor technical equipment of the farms, inadequate organization, use of a non-specific assortment and frequent use of some to vigorous cultivars/rootstocks combinations which entered into productive period to late and lead finally to over crowded orchards.

After 1990, due to the changes appeared by the application of the land property and administration laws (from Law 18/1991 up to Low. 247/2004), the fruit growing registered a significant regress, materialized by orchards surfaces diminution, fruit production reduction, also gradually decrease of the nurseries material stock and planting works.

In the next images are presented some representative aspects of the apple orchards existing in Romania, established 25-30 years ago. Generally the MM 106 rootstock was used, in combination with many cultivars; the canopy shapes used, types „palmete" with horizontal or oblique branches, determined the shadow persistence and poor differentiation of the fructiferous branches and buds in the inferior part of the tree canopies.

The planting distances used were sometimes unbalanced with trees vigor (3.5m – 3.6m / 1.5 – 2.0 m) and the trees high were limited at 2.0 m – 2.2 m by drastically and cost effectives annual pruning and periodic shorten of trees axes.

Figure 1. Apple orchard of 25 years old, trained as „palmete with horizontal branches"

Figure 2. Apple orchard of 25 years old, trained with double rows

Figure 3. Apple orchard of 25 years old, with the trees planted in zigzag.

Such kind of plantations had limited productive and economical performances, also because of the disequilibrium between the growth and yielding processes,

generated by the necessity of more severe prunings (great consumers of high quality labor force), but also due the lack of irrigation water, supplied in required amounts at the right moment.

In the latest years, in the same kind of plantations, sporadic was used the „spindle" type canopy („slender spindle" and „spindle bush"), which offer the possibility of more efficient use of the production space, a better aeration and illumination of the fructiferous branches (figure 4) and offer a higher fruits production and quality, superior to the older plantations.

Figure 4. Apple orchard 5 years old, planted at 4/2 m,
with canopy trained as „spindle" (RIFG Pitesti, Mărăcineni)

In the experiences organized and carried out at RIFG Piteşti the differentiation between fruit growing systems was done taking into account the following indicators: ground use degree expressed by density (trees/ha) or by planting density, the biological material used (species and cultivar/rootstock combinations), trees grumping mode, canopy shape, the fructiferous wall height and thickness, orchard exploitation period, yield amount and quality on surface unit, all of them studied in dynamic, during the exploitation period, the investition value, the human labor force consumption, the production costs and the investition recovery period.

3.2. Meteorological parameters evolution during the last 40 years and their influence on fruit growing

The effects of the Global Climate Warming, the increased frequency of the dry years and not very uniform distribution of the precipitations during the vegetation period, lead to the accentuation of the semiaridity climatic character and its extent also in the hilly zones of the Romania. In this context, we shall present some tendencies of the climate in 1969-2009 period, with consequences on the fruit growing activity.

The polynomial curves of fifth degree trend allow us to affirm that in this period a clear tendency (statistically insured) was directed toward weather warming (figure 5). All determination coefficients for the regression curves are statistically insured, from 1996 to present, the phenomena probability rising up to 50%.

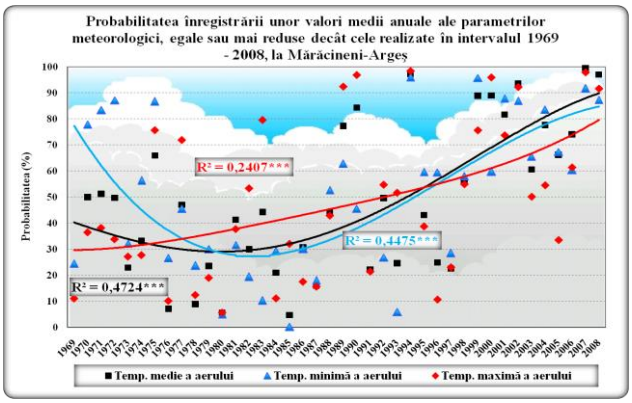

Figure 5. Probability to register some annual average values of the mean, high and low temperatures of the years, equals or lower than the ones accomplished during 1969 - 2008 at Mărăcineni-Argeş.

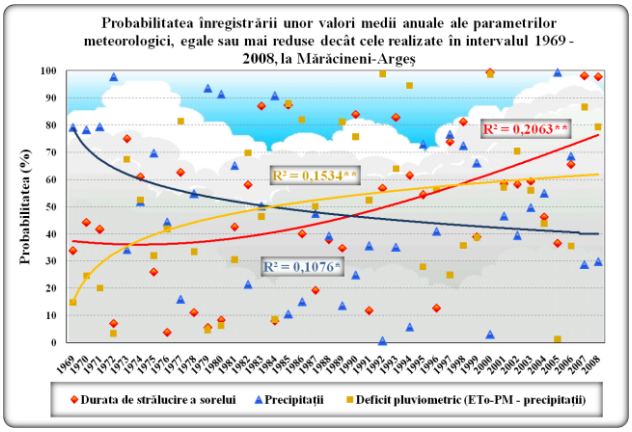

Figure 6. Probabilities to register during 1969 - 2008 the annual sums of sun shine length period, precipitation amounts and pluviometric deficit, equals or lower than the ones registered during the study period.

The same tendency of values increase according the time was evidenced also in the case of sunshine length period (figure 6, R^2=0.2063**) and in the case of the annual medium pluviometric deficit (R^2=0.1534**), but for the precipitations, the general tendency was to decrease (R^2=0.1076).

As regard the intensity of correlation, between the monthly mean values of some meteorological parameters and some years included in the study (simples r, 1969-2009), the table 1 reveal that among the year months that influence the trees entrance into vegetation, February was the month with the most significant

changes; the higher temperature, day-night amplitude and sunshine length period, manifested a rise up tendency, which can determine in the future an earlier entrance into the vegetation of the fruit trees.

Table 1. Correlations intensity between the monthly average values of some meteorological parameters and the years of study (simples r correlations coefficients, 1969-2009)

Month	Mean air temperature	Maximum air temperature	Minimum air temperature	Mean diurnal thermic amplitude	Sunshine length period	Atmospheric precipitations
I					0.332*	
II		0.331*		0.426**	0.464**	
III				0.331*		0.303*
VI	0.436**	0.396**	0.307*		0.319*	
VII	0.607***	0.586***	0.373*	0.301*		
VIII	0.559***	0.398**	0.520***			
IX					-0.351*	
X	0.545***		0.473**			

The results regarding the fruit production obtained in the experimental intensive apple orchard, in relation with the experimental factors, in the second and third year after orchard establishment are presented from now on.

3.3. The effect of experimental treatments on fruit growing processes starting with the second year after orchard establishment

The fruit productions registered in the experimental plot are very high for an orchard in the second year: 19.3 - 30 t/ha according the cultivar (Figure 7).

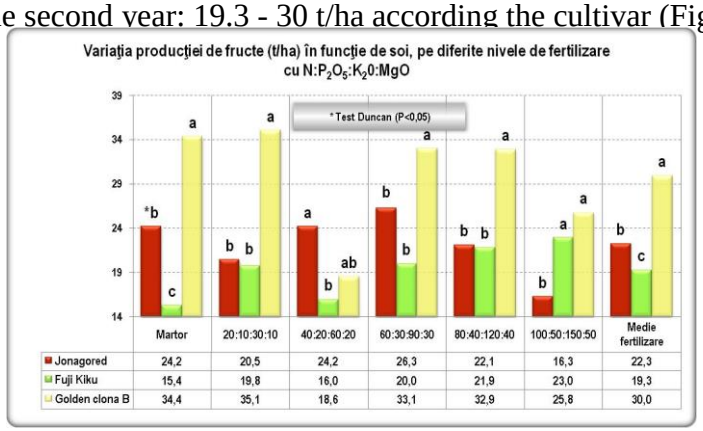

Figure 7. Fruits production variation (t/ha) according to cultivar, in relation with different levels of fertilization with $N:P_2O_5:K_20:MgO$

With small exceptions (fertilization level with $N:P_2O_5:K_20:MgO$ - 40:20:60:20), for all fertilizer graduations, the cultivar 'Golden clone B' yielded the highest production 30 t/ha, followed by 'Jonagored' cultivar with 22.3 t/ha and

respectively 'Fuji Kiku Clone 8' with 19.3 t/ha (Fig. 7), the differences being statistically insured.

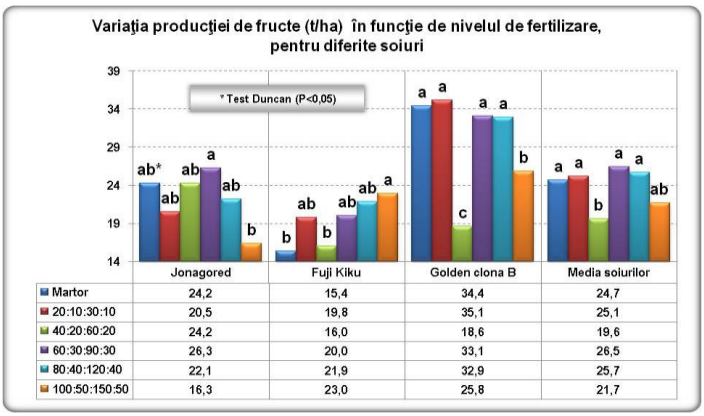

Figure 8. Fruits production variation (t/ha) according to fertilization level, for different cultivars

By assessment of the fruits production variation (t/ha) according to fertilization level, for different cultivars (fig. 8), we can observe that, production levels induced by different quantities of fertilizers are similar from the statistic point of view (21.7 – 26.5 t/ha), with the exception of the fertilization level $N:P_2O_5$:K20:MgO - 40:20:60:20, on which was registered a production of 19.6 t/ha.

3.4. Effect of the experimental variants on the fructification processes in the third year after orchard establishment

Although did not produced the highest number of fruits per tree, 'Jonagored' together with 'Golden Clone B' cultivars provided the highest fruits productions (36.7 and respectively 38.6 t/ha), which differ significantly from the production obtained with the cultivar Fuji Kiku Clone 8 (29.7 t/ha), assessed as regard the means of fertilization levels (Figures 9).

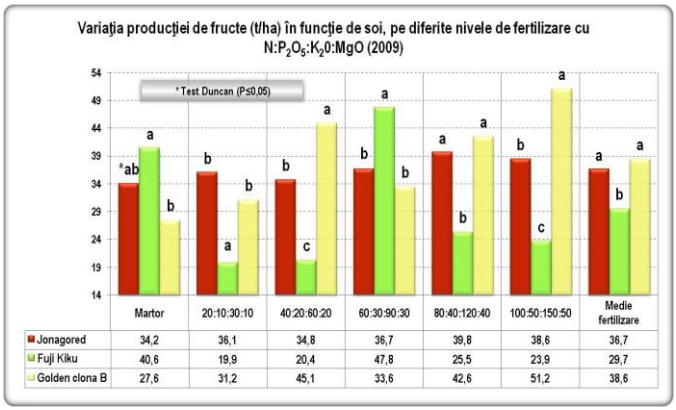

Figure 9. Fruits production variation (t/ha), according to cultivar and fertilization levels.

As regard the fertilizers influence, was noticed that starting with the third year after orchard establishment, the production tend to rise up with the increase of fertilizers amounts, especially nitrogen and potassium (the proportion of these elements rise even more than phosphorus and magnesium in V4-V6 variants), and the production levels arrives at 36.0 – 39.4 t/ha, for cultivars and phytoprotection variants averages (Figure 10).

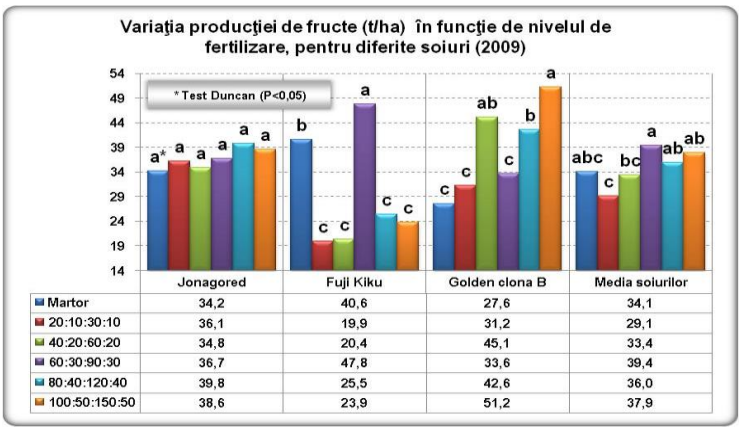

Figure 10. Fruits production variation (t/ha), according to fertilization level (Third year after orchard establishment).

For exemplification, in the figure 11 are presented images taken in the experimental intensive apple orchard established at RIFG Piteşti - Mărăcineni, where the presented production results were obtained.

Figure 11. Intensive apple orchard in the third year after orchard establishment (‘Golden Clone B’ - left and ‘ Jonagored cultivar’ - right)

3.5. Technical and economical indicators for the actual and the perspectives technology

From here we are presenting some synthetic technical and economical parameters that can defines from the economical point of view the applied growing technologies in the table 2 for apple species. In the tables are comparatively

presented the indicators for the actual technology used in the Romanian fruit growing and the indicators for the perspectives technology recommended for a performance fruit growing.

Table 2: Technical and economical indicators for apple species

Crt. Nr.	Specification	M.U.	Quantity or value	
			Actual technology	Perspectives technology
1	Designed capacity	ha	1	1
2	Density	trees/ha	1,250	3,333
3	Total value of the investment	lei	61,134	136,545
4	Exploitation period	years	20	15
5	Annual rate of the amortisment	lei/ha	3,057	9,103
6	Annual expenses for exploitation	lei/ha	13,447	21,930
7	Fruits production planified at the entrance into full bearing period	tons	20	55
8	Average cost price	lei/t	825	564
9	Marketable production	tons	20	55
10	Average price per unit for valorification	lei/t	1,155	1,175
11	Marketable production value	lei	23,100	64,625
12	Annual profit	lei	6,596	33,592
13	**Investment turnover period**	**years**	**9/12***	**4/6***

* For investment turnover two values are given; first value represent the investment turnover period from entering into the full bearing of the orchard, and the second value represent the investment turnover period, from the moment of orchard establishment.

In presented tables it can be noticed that, the investment turnover period is smaller in the case of the perspectives technology application, although the total investments value is higher for these fruit growing technologies.

In this moment, the Romanian fruit growing is on the roads cross and can choose: to remain at the present low technical and economical performances level, or to apply the modern technologies of fruits production, in order to make profit and to gain new markets.

For the future reduction of the cultivated surfaces concomitant with crops intensivization create favorable conditions to diminish unfavorable effects of climatic changes with low costs: fert-irrigation systems, protection systems against frost hail and insolation.

With the large increase in air temperature, in number of hours of sunshine and lower rainfall in the summer months, irrigation techniques will have to evolve within the meaning of efficient exploitation of water resources - is known that drip or micro-sprinklers irrigation techniques distribute water more economically than sprinklers or furrow irrigation.

By increasing the range of vegetative rootstocks it was possible to achieve high density orchards, not only for pome species but also for stone fruit species: the range of apple rootstocks tend to reduce to the type M9 and his clones; for pear is spreading the grafting on various types of low vigor quince rootstocks; the Saint Joulien rootstock is more and more used for plum and Gisela series rootstocks for sweet cherry.

In the high density plantations is necessary to increase solar energy use efficiency by choosing the appropriate type of crown (slender spindle, vertical axis, "V" system, etc.), simplification of crown training technology, removing unproductive areas around the axis, generalization of "green" pruning.

The massive transition to high density orchards requires the generalization of fertigation and support systems settled even before planting. The support function of the branches of low and medium density plantations will be taken by a support system consisting of espalier, wire and bamboo, like individual support (first year production can be 5-10 t ha^{-1}, particularly in pome species).

Conclusions

From the climatic point of view, under the local conditions from Piteşti-Mărăcineni, a clear tendency of weather warming (statistically insured) was noticed, with an increase of sun shine period length and an evident rainfall deficit than 10 years ago, compared with the multiannual values registered at the local weather station;

At RIFG Piteşti-Mărăcineni, in high density apple orchards, application of the intensive fruit growing technology lead to apples productions of 19.3 – 30.0 t/ha, in the second year after orchard establishment and 29.7 t/ha – 38.6 t/ha in the third year after orchard establishment, according with the grown cultivar;

In the intensive orchards, a large amount of investments are needed to apply modern fruit growing technologies, but the obtained fruits productions lead to investments turnover period shortening with five years, both for apple and plum species.

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ORGANOMINERAL FERTILIZERS ON THE LIGNITE SUPPORT – ECOLOGICAL SOURCES OF BALANCED FERTILIZATION OF CROPS IN SUSTAINABLE AGRICULTURE

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Abstract. Obtain high yields on soils with low humus requires systematic fertilization with organic fertilizers to ensure restoration of the reserve of soil humus. Since organic fertilizers are insufficient, and the classical chemical production in time and chemical pollution of soil and groundwater in recent years has taken a large, particularly in countries with advanced agriculture, industrial production of humic fertilizers on lignite support, leonardit and peat. These inferior coal capacity caloric content but with little significant humic acids facilitates the production of fertilizer effects of fertilizers and higher costs relatively lower than those of classical chemical.
In Romania, based on a range of humic fertilizers on lignite support from research conducted by National Research - Development Institute for Soil Science, Agrochemistry and Environmental Protection, Bucharest, was made in a RELANSIN project, in collaboration with SNLO Tg. Jiu a production of these fertilizers with a capacity of over 7000 tonnes / year, which came into service in 2008. In the paper presented the characteristics of fertilizers, the economic efficiency and possibilities to increase crop production on soils with low humus content.

Key words: organomineral fertilizers, lignite, effectiveness

Introduction

Fertilizers produced by industrial-type processes are the most important technical means to influence for plant growth by applying them directly in soil or on plants.

The main category of fertilizers used in modern agriculture are chemicals that are over 90% of industrial production and are used to based fertilized on cultivated land. In this way, essential nutrients elements are introduced into the mass of the explored soil by roots plant to ensuring the growth to average increase yields by 2-3 times compared to that obtained in the unfertilized soils [2].

Following the effectiveness of chemical fertilizers the global production of their to recorded a substantial growth in recent years, from 32 million tonnes in 1961 to 170 million tonnes in 2010-2011 (L. Maine, 2010).

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Scientific research conclusions and a series of effects recorded in agricultural practice highlight after long periods of use of chemical fertilizers and some negative effects from the most important are:

- Reducing or maintaining a low level of organic matter including humic substances formed by natural way in biocenosis processes by which soil acquires many features of fertility and ecological environment.

- Soils and ground water pollution with some chemicals residual accumulated during lengthy chemical fertilization period with negative consequences for soil evolution, environmental protection and quality indices of harvest.

Interest in scientific research in various countries to mitigate the negative effects of fertilization with chemical fertilizers and knowledges gained on the properties of humic acids and their importance in defining the many features that make the soil fertility has led to the idea of using inferior coals containing with large amounts of humic acids in as raw material for production of fertilizer organomineral.

Brown coal (lignite, leonarditul) with low heat capacity as a fuel (in 1400-1800 Kkal / kg coal) but containing large amounts of non-metamorphosed or partially metamorphosed free humic acids into humic than 25-30% fully justifies their use for the manufacture of organo-mineral fertilizers with significant ecological features.

Today in many countries: America, Japan, China, Israel, Spain, Russia, are many companies that produce humic fertilizers on industrial level.

Given the fact that these fertilizers are used on land growing by technologies including actions to improve plant nutrition in environmental conditions may be estimated that fertilization with humic fertilizer is evolving as a new global strategy.

In Romania the research to produce humic organo-mineral fertilizers started four decades ago [3, 18] and it was continued till now within the framework of some interdiciplinary supported by many scientific researches institution, universities and factories.

These fertilizers have been created as a result of needed fertilization systems improvement to improve fertility sands, eroded soils, soils luvic and other soils with low humus content and all sands developed for irrigation.

At present, are authorized 6 types of humic fertilizers on lignite support which are produced, in a pilot installation more than 7000 t fertilizers per year, put into operation in 2008, built at Tg. Jiu by the National Research-Development Institute for Soil Science and Environmental Protection – ICPA, Bucharest, in cooperation

with National Lignite Society, Oltenia, Tg Jiu, within the framework of the Relansin project, 2003-2005.

At the same time with the starting of this installation function, at present being in the final (and modernization) stage, a real base has been created to extend the production of fertilizers on lignite support in Romania [8].

The opportunity to obtain the organo-mineral fertilizers from lignite in Romaia due to the important lignite reserves in Romania, in the large missing exploitations of Oltenia, with organic matter (OM) content of 60 – 69 %; humic acids SiO_2 and other mineral substances 15 – 30 %; humic acids (AH) 25 – 30 [8,11].

In this paper was presented the fertilising qualities of the organomineral fertilizers on lignite support with prospects of manufacturing in the industrial system for use in large-scale in farms of Romania.

Materials and methods

Organo-mineral fertilizers on lignite support presented in this paper are technology mixtures of powder of coal-rich in humic acids with urea or urea and ammonium phosphates.

There have been two types of fertilizers:

♣ organo-mineral fertilizers on lignite support granulated in successive layers with amide solution;

♣ organo-mineral fertilizers on lignite support granulated in successive layers of humic acids extracted from lignite as potassium humates.

General technological scheme for manufacture of these fertilizers is shown in Figure 1.

Research conducted includes two parts:

♣ Compositions and fertilising characteristics of fertilizers made;
♣ The effectiveness their of plant nutrition and soil fertility features.

1. Results and discussion

Assortment of organomineral fertilizers on lignite support carried by the technological scheme shown in Figure 1 differs in composition compared with used technology, the content of natural coal and soluble humic acids and mineral nutrients content.

Table 1.1 presents the composition of organomineral fertilizers called L-200 L-300, SH-210 and SH-120 containing humic acids as naturally form existing in lignite and are granulated in successive layers with amide solution.

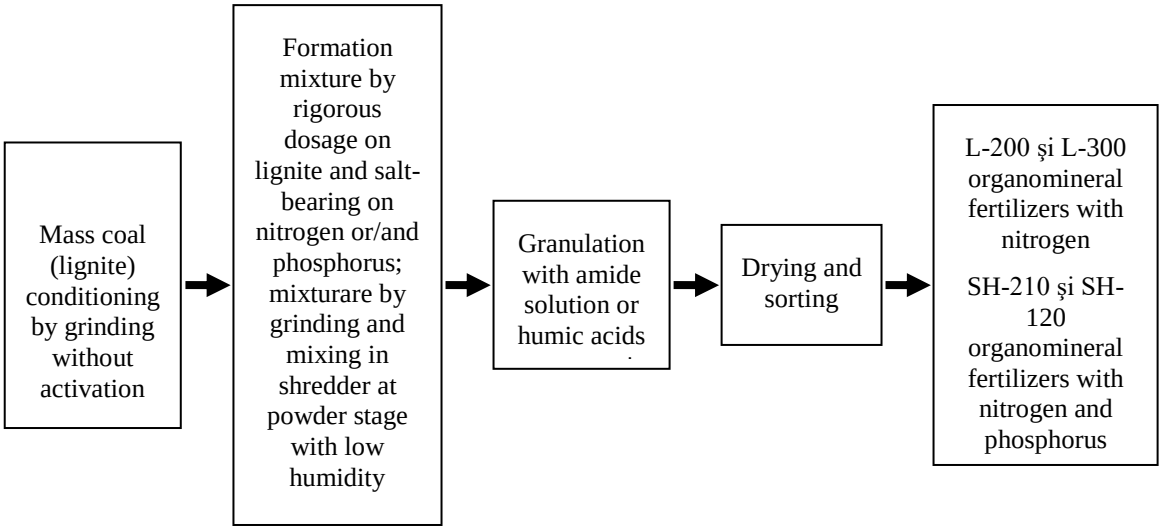

Figure 1. – General technological scheme for organomineral fertilizers on lignite support in the form of technology mixtures with nitrogen-bearing salts or nitrogen and phosphorus [8, 9]

Table 1.2 presents the composition of organomineral fertilizers called L-200 HK, HK L-300, SH-210 SH-120 HK and HK containing humic acids both in naturally form and as potassium humates form representing a significant share in humic mass.

Potassium humate extracted with potassium hydroxide from lignite containing: 58 - 60 g/l free humic acid; 0.8 g/l heterocyclic nitrogen, 9.6 g/l K_2O and some microelements from coal, has a essential effect on quality of new humic fertilizers.

Spectral analysis of potassium humates extracted from lignite to attest similar quality on humic acids from lignite to those resulting from natural products humification (Dorneanu et al. 2010).

Table 1.1 Composition and characteristics of organomineral fertilizers on lignite support granulated in successive layers with urea solution, made from installation in SNLO Tg. Jiu approved for use in Romanian agriculture

No. crt.	Specification	UM	L-200	L-300	S H-210	SH-120
1	**Compozition**					
1.1	Humic acids	%	16.0	10.0	17.0	22.7
1.2	Nitrogen (Nt)	%	22.0	28.0	20.55	9.15
1.3	Phosphorus (P_2O_5)	%	-	-	9.75	16.50
1.4	Potash (K_2O)	%	0.255	0.197	0.226	0.307
2	**Properties**					
2.1	Cation exchange capacity	me/100 g	48.0	35.8	41.0	55.7
2.2	Apparent density	g/cm3	0.738	0.707	0.720	0.813
2.3	Grain size (1-5 mm)	%	82.0	86.0	79.3	88.6

Table 1.2 Composition and characteristics of new organomineral fertilizers granulated in successive layers with potassium humate, which is pending approval and will be manufactured in the SNLO Tg. Jiu upgraded installation

No. crt.	Specification	UM	L-200 HK	L-300 HK	SH-210 HK	SH-120 HK
1	**Compozition**					
1.1	Humic acids	%	29.9	24.3	28.5	26.4
1.2	Nitrogen (Nt)	%	23.49	29.21	21.97	10.47
1.3	Phosphorus (P_2O_5)	%	-	-	9.75	16.50
1.4	Potash (K_2O)	%	2.80	2.80	2.80	2.80
2	**Properties**					
2.1	Cation exchange capacity	me/100 g	96.3	75.2	70.3	83.9
2.2	Apparent density	g/cm3	0.823	0.782	0.801	0.852
2.3	Grain size (1-5 mm)	%	89.9	92.3	88.9	93.5

Fertilising qualities of organomineral fertilizer on lignite support

▪By their characteristics, organomineral fertilizer have effects of enhanced plant nutrition, of improvement of soil fertility properties and prevent a significant degree of pollution of soil by fertilization.

▪Because potting humic compounds and salts with nutrient in organomineral matrix which increases the adsorption and cation exchange capacity of the soil, these fertilizers are the main feature high mobility of the elements that contain them, either through solubility, either through constant change in ion form on elements of humaţes with other ions in soil solution and by partial mineralization.

▪Because of carboxyl functional groups (-COOH), phenolic hydroxyl (-OH), carbonyl (> C ═ O) and metoxylilic (-OCH3), humic acids can bind different metal ions in soil solution (B, Fe, Cu, Mo, Zn), giving rise to chelates with important role in plant nutrition and soil fertility status[9].

▪In more recent research has found that agents humic chelates act as physiologically active substances, they can enter the plant roots and are transported to the leaves. Between supply soil solution with humic chelating agents and their absorption by plants was identified the existence of a perfect parallelism quantitatively.

▪Research conducted proving the effectiveness of humic acids and humic chelates in germination and vegetative growth stimulation. It shows a strong increase of the root system.

▪Humic acids compounds with metal ions (Ca, Mg, Fe, Al) are insoluble in water, formed precipitates - film or micro accumulation on place training. As a result of humic acids from organomineral fertilizers on lignite support, contributes to formation of main binder of colloidal particle of agglutination of clay minerals, fine dust and sand.

Thus, by the participation of the humic acids in the formation and cementing of the micro aggregates and macro aggregates, hard coal organomineral fertilizers contribute greatly to the development of the soil structure. This correlates with the increase of porosity in a favorable ratio between the non capillary space available for rainfall or irrigation water infiltration and capillary space which holds large amounts of resisting water equivalent to 3-5 times the total weight of organic matter (humus).

Effectiveness of organomineral fertilizers to classics chemical fertilizers

In tables 2 and 3 are listed the types of organomineral fertilizers obtained in installation realized within RELANSIN project in technology samples on manufacturing of several tens of tons.

Organomineral fertilizers on lignite support successively granulated with urea solution constituted the objective to build the pilot instalation in Targu Jiu within Relansin program and have been tested a great number of years on different soil types achieving effective results [8].

Table 2. Yield increases obtained with organomineral fertilizer granulated with urea solution applied to maize HF-420 grown on psamosol (sandy soil) irrigated on Development Research Centre for Plant Culture on Sands, Dăbuleni-Dolj

Dose of fertilization: N-200; P_2O_5 -100; K_2O-100 kg/ha

No.	Variants	Average production of grains (on 5 years) kg/ha	Yield increases			
			kg/ha	% to		kg grains/ kg fertilizer (N-P_2O_5-K_2O)
				M1	M2	
1	Unfertilized (M1)	2808	-	100.0	-	-
2	Urea.TSP*. Potash salt (M2)	5290	2482	188.4	100.0	6.2
3	L-200. TSP* Potash salt	6210	3402	221.1	117.4	8.5
4	L-300.TSP* Potash salt	6136	3328	218.5	115.9	8.32
5	SH-210 Potash salt	6353	3545	226.2	120.0	8.86
6	SH-120. Urea Potash salt	6359	3587	227.7	120.8	8.96
			620			
	DL 5%		620			
	1%		900			
	0,1%		1180			
	*TSP triple superphosphat					

To highlight the effectiveness and efficiency are presented in table 2 the results obtained from irrigated maize on psamosol at Development Research Centre for Plant Culture on Sands, Dăbuleni-Dolj, since the sandy soil is conventionally considered most suitable for testing the effects of fertilization with different types of fertilizers.

Production increases on maize in the experience mentioned are higher in variants with fertilizers organomineral with 15.9 up to 20.8% compared to fertilization with mineral fertilizers.

These fertilizers are recommended for intensive crop fertilization on soils with low humus content (sandy soils, and eroded Luvisols) to humic improvement.

Table 3 presents the results of testing the effectiveness of H-200 HK and SH -120 HK fertilizers compared with L-200 and SH-120 fertilizers applied to maize grown on luvisol albic (podzolic).

Table 3. The effectiveness of L-200 and SH-120 organomineral fertilizers applied comparatively with L-200HK and SH-120HK on maize on luvisol albic (podzolic) in Development and Research Horticultural Station Tg Jiu - Gorj

No.	Types of fertilizers	Quantity applied			Average production of grains (on 2 years) kg/ha	Yield increases		
		Physical product kg/ha	Active substances %/100 kg	Total on 500 kg physical product kg/ha		kg/ha	Physical product kg/ha	Active substances %/100 kg
1	Martor nefertilizat	-	-	-	2600	-	100.0	-
2	L-200	500	22.0+0+ 0.25+16.0= 38.2	191.3	3200	600	123.0	3.14
3	L-200HK	500	23.5+0+ 2.8+29.9= 56.2	280.3	3700	1100	142.3	3.92
4	SH-120	500	9.2+16.5+ 0.3+22.7= 48.6	243.3	4280	1680	164.6	6.91
5	SH-120HK	500	10.5+16.5+ 2.8+26.4= 56.2	280.4	4450	1850	171.1	6.60
	DL 5%					370		
	1%					518		
	0,1%					703		

Modest doses were applied to highlight the minimum effects of these fertilizers between 500 kg/ha physical product and 191-280 kg active substance in which items were included both NPK and humic acids.

Yields increases obtained with organomineral fertilizers from unfertilized variant were higher from 23.0 to 71.1% significantly distinguishing for granular fertilizers with potassium humates.

Analytical data from preliminary tests shows a higher efficacy of these fertilizers because have a rich content in potassium humates.

These fertilizers are indicate for intensive crops fertilization on all soil types.

Conclusions

On the basis of presented data, it may be estimated that the organo-mineral fertilizers on lignite support, due to their content in humates. have a series of specific properties that impart them higher fertilization qualities as compared to the classical chemical fertilizers;

Incorporation into organo-mineral matrix with humates ensures the assimilation of nutrients at a higher proportion than by applying chemical fertilizers. and the soil chemical pollution degree is significantly reduced;

Use of fertilizers on lignite support presents the advantages that they can economic efficient use, under higher conditions a significant part of the more than 4 milliard tones of coals with humic acids existent in Romania and they can ensure a humic fertilization of an important land area of the more than 7 million ha of humus deficient soils.

An essential economic advantage of production of organo-mineral fertilizers on lignite support is represented by the lower energy consumption and production costs, having in view the contribution of active ingredient in coal which are less than costs of the chemical fertilizers with 22-25%.

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CLIMATIC CHANGES AND THEIR EFFECTS ON THE ENVIRONMENT

Adrian BAVARU[1], Rodica BERCU[2]

Abstract. Over the past few decades, there have been modifications of the climatic factors, the intensification of meteorological phenomena that deviate from the normal and have a negative influence on the natural frame and on life in general. According to the specialists in the field, all these climatic modifications start from the phenomenon of global warming caused mainly by the anthropogenic influence which leads to the occurrence of the so-called "greenhouse effect". The consequences of this phenomena is analized in the present paper. Due to the expansion of dry areas and the shortage of drinkable water, both life in general and human life will be affect as well. The temperature increase will lead to the melting of glaciers and ice caps or the two poles as well as causing the floods effect in the costal and islander zones of Terra. Finally, is mentioned a last novelty from astrophysic field, that „beginning with 2014 on the Earth will start a climate cooling in a new "ice age"

Key words: global worming, climatic factors, environment

Introduction

Over the past few decades, there have been modifications of the climatic factors, the intensification of meteorological phenomena that deviate from the normal and have a negative influence on the natural frame and on life in general.

The specialists are warning that a global modification of the climate – if it should occur – "would be the most dangerous natural risk possible for humankind and quite possibly the greatest of all possible natural risks."

The anthropogenic activity currently tends to determine a global modification of the climate and consequently modifications of the environment (we are not discussing the natural causes that occurred in the past). Even though climatic risks take place in all the parts of the globe – the specialists consider that the temperate zone witnesses the most numerous and various climatic risks that affect the environment (thus, our zone as well) [1].

In 1995, the scientists from GIEC (The International Group of Experts for the Study of Climatic Changes) warned that the Earth entered a period of climatic

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instability that would lead to the degradation of the economic and social environment, and off course, of the natural frame. Consequently, the UN created the so-called Intergovernmental Panel on Climate Change (IPCC) which, together with the other two instances mentioned above (and others), periodically analyzes in joint sessions the current problems of the global climate, also adopting appropriate measures which are presented then to all the countries. We also find that nowadays there are more and more unusual meteorological phenomena such as: very high temperatures in summer, diluvial rain and catastrophic floods, strong winds and storms in the form of hurricanes, tornados or typhoons that occurred in our country too (even this summer).

According to the specialists in the field, it is believed that all these climatic modifications start from the phenomenon of global warming caused mainly by the anthropogenic influence. The increase of temperature leads to the occurrence of the so-called "greenhouse effect". Huge quantities of gases have accumulated in the atmosphere such as carbon dioxide (in great concentrations), methane (which causes a greenhouse effect ten times more than carbon dioxide), nitrogen dioxide, fluorocarbons etc. This phenomenon was observed starting with 1980 when a NASA researcher reached the conclusion that these gas accumulations resulted after the burning of oil and other fossil fuels increase the global temperature.

If the average temperature on Earth increased by $1^{o}C$ in the 20^{th} century starting with 1990, the warming rate will increase even more rapidly and if the rhythm is maintained, the temperature will increase by at least $1^{o}C$ up to approx. $5^{o}C$ or even more towards the end of the 21^{st} century (according to Hubert Reeves, 2005).

The developed countries, with a strong industry and a large number of cars, are the main guilty parties in this disaster: see Figure 1, 2. Consequently, at the UN conference from Copenhagen in December 2009, over 100 country leaders decided to limit the increase of global temperature to $1.5\text{-}2^{o}C$. However, the signing of a new treaty fails.

In 1997 in Kyoto (Japan), at the international Conference dedicated to the accumulation of toxic gases and to the greenhouse effect, an immediate reduction of carbon emissions of 5% was established to take place by 2012 (compared to the 1990s). Today, this percentage is inadequate and insufficient. New proposals were made, namely to reduce at half these emissions by 2050. We must also specify that the Kyoto protocol expires in 2010.

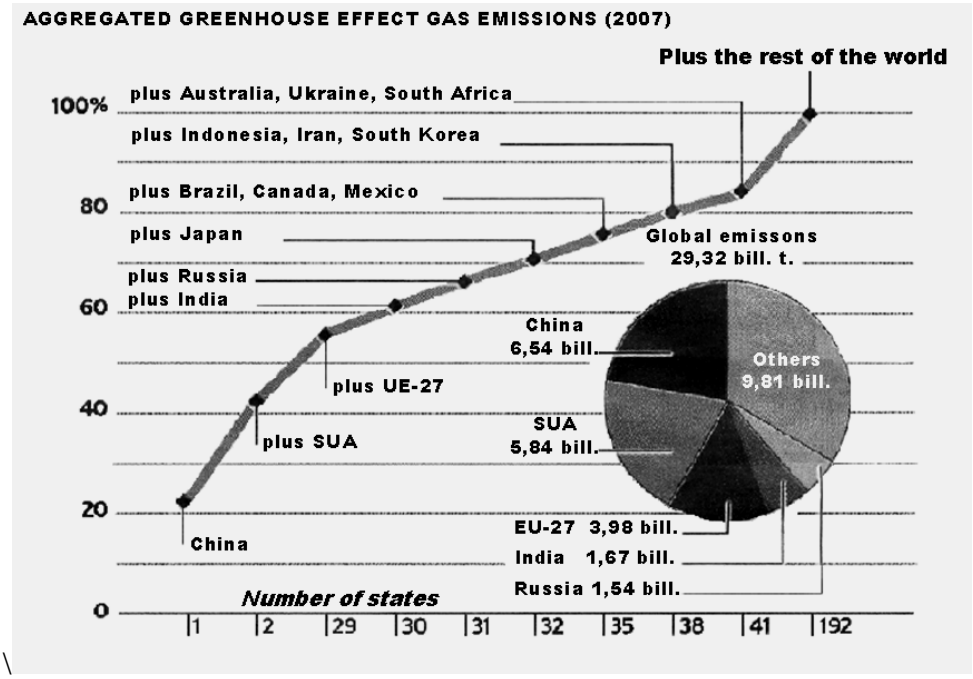


Figure 1. Aggregated greenhouse effect gas emission diagram.

Figure 2. Gas emissions due to:
a. a large number of cars; **b.** developed countries, with a strong industry.

At the next conference, in Copenhagen in December 2009, dedicated to climatic modifications, Europe decided on a reduction of the emissions of 20% by 2020, and even 30% if other countries on other continents agree. However, China claimed the right to continue to emit greenhouse gases in the same quantity as the industrialized countries, but pledged to reduce their intensity by 40-45% by 2020, if other countries do the same. For a better understanding of the seriousness of the phenomenon of gas accumulation in the atmosphere, we will give a statistics for

2007 realized by one of the specialized UN organizations, "U.N. Statistics Division Millenium Development Goal". The conclusion was that 35 developed countries generate ¾ of the total gas emissions (of all the 192 UN countries). We must also specify that, given the rise of industrial production, China increased (not reduced) the gas emissions, reaching the level of emissions from Russian and the USA together. In 2009, China produced 7.43 billion tons of emissions, while in 2008 it produced "only" 6.8 billion tons. At the same time, the USA produced 5.95 billion tons, like in 2009. Another fact is that, at global level, the greenhouse gas emissions decreased by 1.3%, reaching 31.3 billion tons in 2009. It is a good but timid start.

Our country also reduced the emissions in 2009, reaching second place in Europe, after Estonia, with only 42 million tons, given that our annual quota is 76 million tons. At the EU level, the emissions decreased by 11%. All these are explained by the current global recession, but also by the increased investments in alternative energy sources (solar, wind etc).

The industrialized countries are not too willing to take more decisive measures for a drastic reduction of the gas emissions that cause the greenhouse effect. This was obvious at the Copenhagen Conference. Thus, they are willing to pay even a high price for this pollution. For example, the USA wants to use 100 billion dollars by 2020 in order to fight the climate modifications if other industrialized countries do the same. Australia, France, Japan, Great Britain, Norway and the USA announced immediately a financial aid of 3.5 billion dollars for three years with the purpose of taking measures to stop deforestations in the third world countries (with tropical and equatorial climate where the "green lung" of the Earth is located) [2]. Japan alone offers huge amounts of money for other measures just as long as it is not forced to reduce the emissions of toxic gases: see Figure 3.

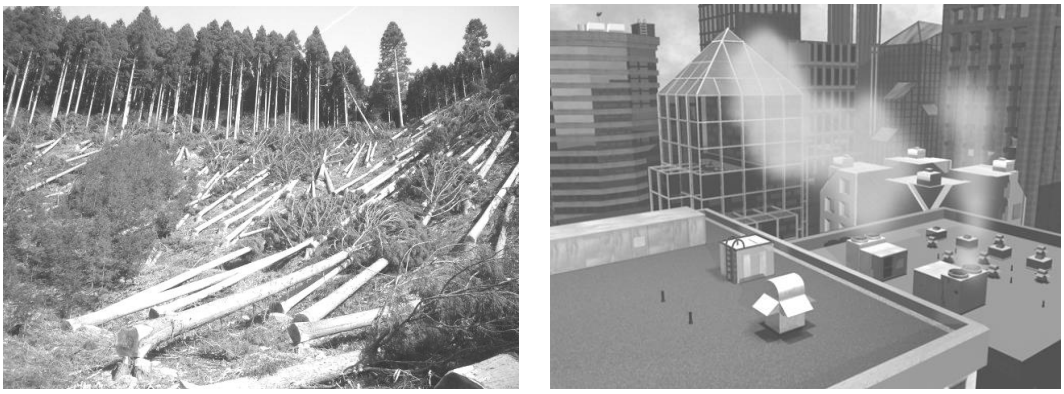
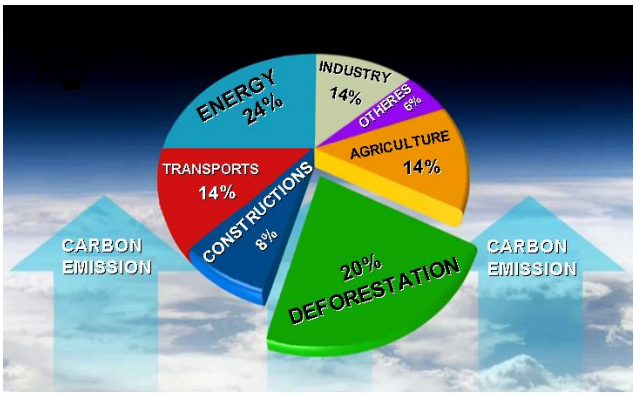


Figure 3. Greenhouse effect and climate modifications caused by:
a. deforestations; **b.** emissions of toxic gases.

The calculations accomplished by the researchers from the "Geophysical Research Letters" show that a layer of soot accumulates in the atmosphere. It is resulted from the launching of rockets: see Figure 4. This leads to the cooling of the Earth by 0.7°C, but in the Antarctic area, the temperature will be 0.8°C higher. Moreover, the ozone layer in the stratosphere will be affected. It protects us against the UV rays and it will be thinner at the Equator by 1% and at the poles by 10%. Consequently to the warming by 1°C at the poles, the ice caps will be reduced by 5-15%: see Figure 5.

Figure 4. A layer of soot accumulates in the atmosphere:
a. caused by launching of rockets; **b.** the expansion of dry areas will also affect agriculture.



Graficul cauzelor schimbărilor climatice şi apariţia "efectului de seră"

Figure 5. The reasons of climate changes and the release of greenhouse effect.

What are the consequences of global warming by 2-3°C on our planet in the future?

Firstly, the specialists estimate that approx. 3.4 billion people (over half of the current population of the Earth) will suffer profoundly because of the shortage of drinkable water, due to the expansion of dry areas, salinization and soil degradation: see Figure 6.

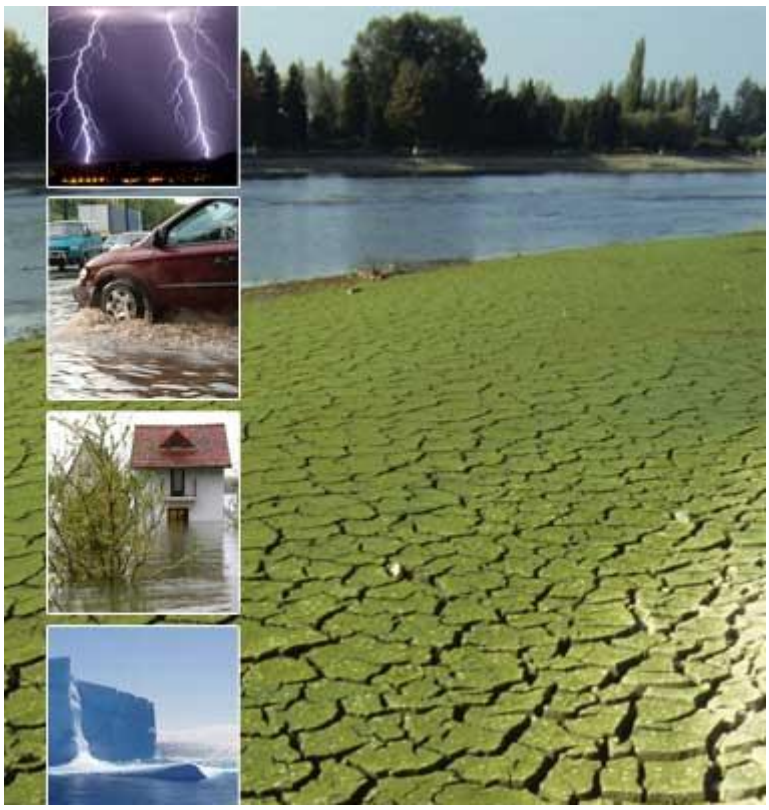


Figure 6. Shortage of drinkable water due to the expansion of dry areas, Salinization and soil degradation.

Until 1970, the dry and arid zones of the globe represented approx. 15% of its surface. However, by 2002 the value reached 30% (it doubled in 32 years) and unfortunately these areas continue to expand [3]. Let us discuss our country, where the average annual temperature has risen by 0.8^{o}C over the past decade. As a consequence, southern Romania, including Dobrogea, is in danger of becoming arid, as the summers here are very hot. In the summer of

2007, in the county of Braila, there was no rain for 147 days and the temperature in the summer months was approximately 40^{o}C. Consequently, all the century-old trees protected by the "Balta Mică a Brăilei" National Park have dried out! In turn, the Park has been taken over by grasses and weeds characteristic to ruderal steppe and which have no value, on the contrary [4].

Secondly, as a result of temperature increase in the warmer zones of the globe, there will be an increase in fires (a fact often present in the mass-media). In the USA, the researchers have recently shown that an increase of temperature by 1.6^{o}C during the warm period of the year will double the number of natural fires and especially anthropogenic fires, mostly in the western part of the USA (California, Texas etc): see Figure 7.

Figure 7. Natural fires.

Thirdly, the temperature increase will lead to the melting of glaciers. The northern hemisphere will be the most affected and zones such as Alaska, the north of Canada, Siberia, and Greenland will suffer the most: see Figure 8. The specialists estimate that an increase of temperature by 4^{o}C (which we hope not to happen) will melt almost the entire glacier cover of Greenland, which would lead to an important increase of the sea level – between 2 and 7 meters on long term. This summer, a huge block of ice broke from a glacier in Greenland. Its surface was bigger than that of Manhattan, according to the American specialists that also signal that in 2010, the arctic bank melted 50% faster than usually (according to the specialists from the National Center for climatic data in the USA).

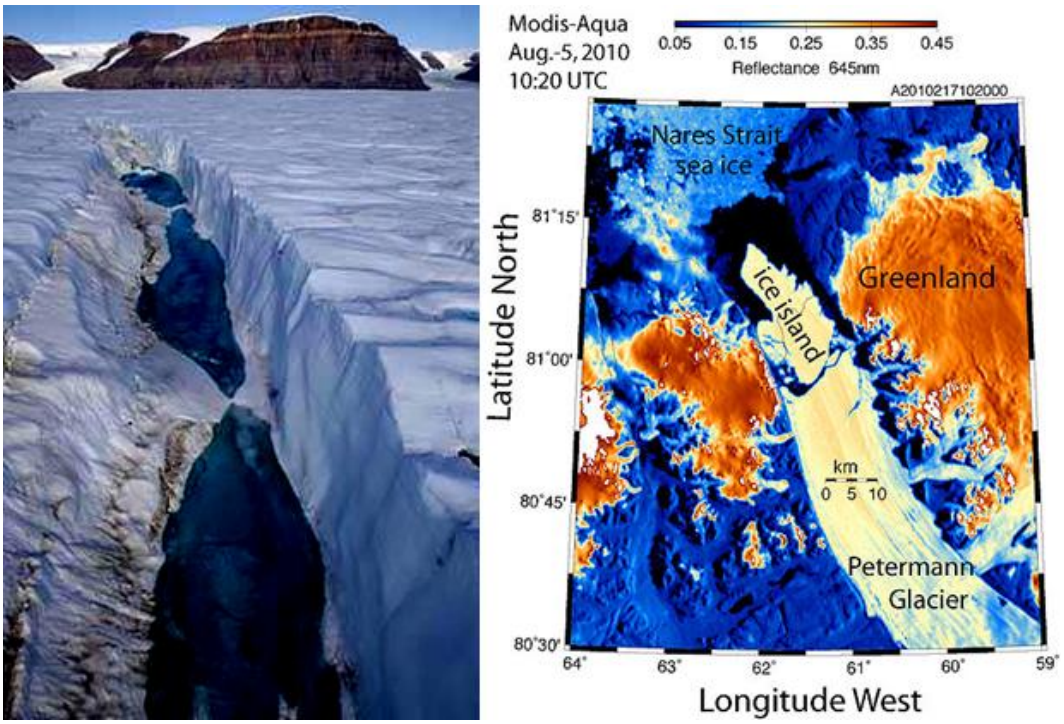


Figure 8. Patermann glacier fracture in Greenland, satellite image.

The researchers from the prestigious American Universities, Howard and Princeton, have recently published a study in which they warn that a continuation of the temperature rise – of the global climate warming – will lead to the melting of the ice caps in the northern and southern hemispheres in a few hundred years: see Figure 9. This would be a disaster for Earth because the seas and oceans will rise by 9 meters, more than the value estimated by the specialists at the Intergovernmental Panel on Climate Change (IPCC) that talked about 2-7 meters, as mentioned above [5].

Figure 9. Melting of the ice caps.

The experts from NASA and the National Snow and Ice Data Center (NSIDC) from Boulder, Colorado (USA), appreciated that the first eight months of this year have been the warmest of the last 131 years, when temperature was on average 0.7ºC higher than between 1951 and 1980. The temperature of ocean waters, also risen above the average, played a decisive role in the decrease of the arctic ice level. The specialists from Washington University appealed to the technique of mathematical modeling and demonstrated that the total volume of arctic ice is the most reduced so far, 10000 km^3 m smaller than 30 years ago. They also demonstrated that the volume of ice is reduced by 17% each decade.

Last year, in 2009, the experts from Cambridge University (Great Britain) also warned that in 30 years time the arctic bank would disappear and the Arctic Ocean will become a safe maritime route. The American specialists believe that if the temperature continues to increase, in 2030 at the latest, the arctic zone will be a memory (in only 20 years time!). The team led by professor Robert Kopp, from Princeton University, shows that during the last interglacial period, 125000 years ago, the ocean level was 6.6-9 higher than today because of the temperatures at the two poles, which were 3.5ºC higher. The more and more accentuated global warming that we are living at the moment will have the same consequences, claims professor Kopp. Also, the glaciers in the mountain ranges in the northern hemisphere melt causing thus local floods [6], while the small glaciers will disappear completely (touristic attractions): see Figure 10, b.

Currently, the ice layer at global level loses 51 km of its surface annually. Let us specify another aspect: glaciers occupy only 11% of the Earth surface but they contain ¾ of its drinkable water. If temperatures increase more than 1.5-2ºC, as we showed they could, and no decisive steps are taken, large surfaces will be flooded, especially in the coastal area: see Figure 10, a. This will lead to the

migration of hundreds of millions of people from these places [7]. The territories of Oceania, the Maldives etc or even whole countries such as Bangladesh could lose up to 18% of their territory. What about the Netherlands, or the great coastal cities such as New York, Shanghai, New Orleans, South of Florida, Rotterdam or Amsterdam?

Figure 10. Global warming might cause:
a. large surfaces to be flooded in the costal area; **b.** small glaciers to disappear.

A document, elaborated based on studies made by researchers together with experts in insurance (in order to estimate the damage that might occur), released recently in 2010, has shown that this increase of the ocean level as a result of temperature rising and glacier melting, could affect 149 touristic resorts in the Caribbean, some disappearing completely. Thus, the life of hundreds, maybe even millions of people in the area will be affected. The costs of the disaster are estimated to approximately 187 billion dollars by the end of this century. It would represent a great burden for the 15 countries, members of the Community of Caribbean States. The results of this study will be presented in November 2011 in Mexico at the Conference on climatic problems and we hope it will lead to the signing of a new Cancun treaty.

All the American specialists from the Meteorological Center mentioned above consider that the entire North America could lose 50% of the coastal wetlands.

Add to these floods those caused by unusual precipitations that have turned creeks into rivers and that erase everything in their path, especially in the hill or mountain areas. Thus, we will have a more exact picture of this phenomenon and we will understand better what the floods cause by climatic changes mean: see Figure 11 [8].

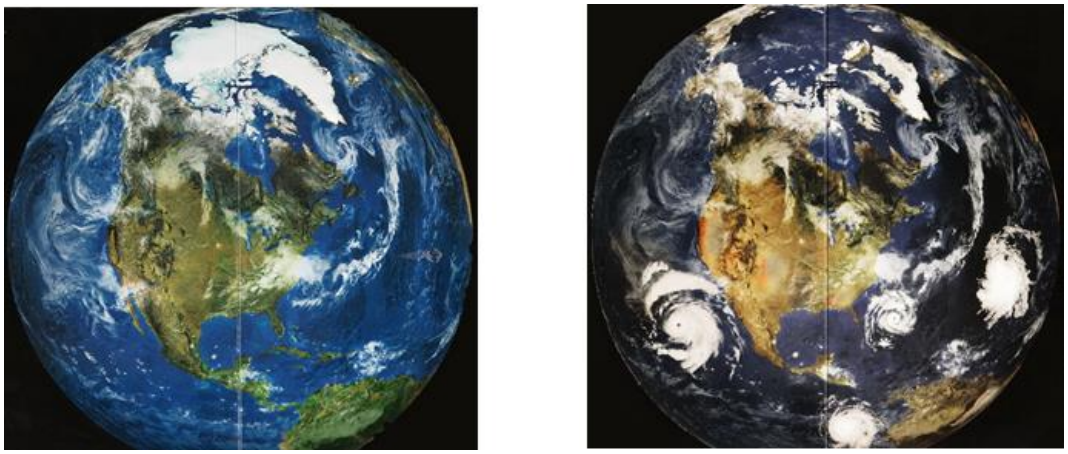


Figure 11. The image of the Earth:
a. with deep oceans, rich soil and green forests;
b. desolated by climatic changes.

After we presented the recent phenomenon of "greenhouse effect" and its concrete consequences, a new bomb was launched by the mass-media at the beginning of this summer: the global cooling of the climate.

An astrophysicist of Uzbek origin, Habibullo Abdussamatov, the director of Space Research at the Pulcovo astronomic observer in Sankt Petersburg, declared at the International Conference on climatic changes (Chicago, USA) that in three years time there will be a process of climate cooling (2014) and that the current warming will end in 2012, so we people must prepare for a new "ice age." This will be owed to the Sun whose radiation power will decrease suddenly, after a century of intense solar activity.

The fact itself is a consequence of the reduction of sunspots, solar activity entering a "minimal" phase. According to the specialist, we must exclude the theory according to which the developed countries are responsible for the large volume of greenhouse gases (I believe he is a good friend of Putin and Medvedev, as they are also original from Sankt Petersburg).

So, the industrialized countries are innocent victims of scientists. As argument, he claims that even on Mars, which is 55 million km from Earth, where no people exist, information is gathered by means of ecological robots and the results are that the greenhouse effect is present on Mars too and it reduced the ice layers, a fact discovered and described by astrophysicists on this planet, more precisely, at the south pole of the red planet.

We shall soon see whether he is right or not.

Conclusions

The recent changes of the climatic factors have led and lead to the emergence of weather phenomena that deviate from normal producing a negative impact on the natural frame and human life.

According to experts, these climate changes due to global warming of the planet – man-caused - and placing so-called "greenhouse" effect

The consequences of this process are the following:
- reduction of water resources especially in warmer areas and expanding aridizare process in these areas being affected people's life.
- the emergence of increasingly frequent fires during the hot periods of the year.
- the glaciers melting, polar ice caps and the glaciers in mountain areas.
- as a result of their melting, the oceans levels will rise causing dagerous flooding in many regions of the world.

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THE ECONOMIC IMPACT OF CLIMATE CHANGE - EVIDENCE FROM GRAPE OUTPUT AND RANDOM FLUCTUATIONS IN WEATHER

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Abstract. Grape Yield and Quality have been studied for 11 vine types (White Feteasca, Royal Feteasca, Aligote, Sarba, Cabernet Sauvignon, Merlot, Black Babeasca, Black Feteasca, Chasselas Dore, Hamburg Muscat and Black selected Coarna) in close relation to weather conditions in the years 2007 and 2008 at Bujoru Vineyard in the South Eastern Romania. The Index Method, Gain Method, Share Method, Comparison Method have shown the evolution and importance of 22 climate factors and their impact upon grape yield, production and quality. Important differences have been noticed by vine type concerning grape yield and quality. The increased level of climate factors in the year 2008 compared to 2007 determined an increased acidity, grape weight and volume, but a decreased sugar content for almost all the vine types.

Key words: economic impact, climate change, grape, production

1. Introduction

Climate change has a deep impact on physical and biological systems in many regions of the world and this process is expecting to continue in the coming years. According to IPPC Working Group, in the 20th century, the average surface temperatures at world level have increased by 0.6 – 0.9 degrees and in the 21st this warming trend will continue so that in 2010 temperatures will be 1.4 to 5.8 degrees higher than 1990[16].

This world trend varies by region and would lead to changes in the variability of climate and in frequency and intensity of some extreme phenomena.The vulnerability of the bio systems depends on their social, economic and environment conditions. [3, 4, 15].

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The impacts of climate change on agriculture will differ by region [5, 11,16].While in some regions agricultural production may decrease, e.g. due to decreasing crop productivity or losses in acreage, in other regions it may benefit from warmer and more humid climate. Producers will respond to climate-induced changes in production conditions by changing their behavior and therefore, lessen direct negative effects and, respectively, strengthen the direct positive ones.

More and more research studies are focused on the assessment of climate change economic effects [3, 4, 5, 8, 11, 15, 16]. Direct climate impacts affecting agricultural production can be modeled as changes in parameter values of production functions or as changes factor endowments. Information on the magnitude of qualitative and quantitative changes in the production function of the agricultural sector can be derived from physical impact studies [5, 8]. Taking into account that climate change has a regional impact, various simulations with regionalized climate economy models have been already carried out [3].Other studies have developed integrated ecological-economic models, encompassing climate scenarios, agro-ecological zoning information, socio-economic drivers as well as world food trade dynamics [8].

World climate change has a deep impact upon viticulture in terms of growing areas, grape production, product quality and efficiency [1, 2]. Predicted changes in the climate of European viticultural regions over coming decades may alter significantly both the spectrum and the distribution of grape varieties currently used [2]. Due to the higher temperatures, the traditional limits for grapevine cultivation are changed and also phenological aspects, grape production and quality as happened in the Western Europe, mainly in France during the last 15 years [6,18]. EXPERT systems have been set up in order to monitories the global climate factors affecting ecological items, vine growing technologies, plant protection and economic performances in the vineyards situated in the hilly areas [18]. Various scenarios for the future global climate change are set up (HadCM3 climate model, general circulation models GFDL, GISS, OSU, UKMO), forecasting an increase of the average global warming by 2.04 ºC in the period 2000-2049 and in Europe by 2.5 ºC- 4.5ºC in summer and by 3.5 ºC - 6 ºC in winter. In such a situation, vine growing could be extended from Northern England to Ukraine and Southern Russia, from Northern Ireland to Southern Denmark. Besides temperature, the environment factors could also affect the vegetation evolution and production [6]. Global warming could determine desertification and affect viticultural ecosystems [6,7]. Grape and wine production in close relationship to economical and financial aspects must not be neglected [9,10, 12,13,14]. Climate change projections are used to produce ‘cost’ impact models and viticulture-suitability maps.

In Romania, climate change impact in viticulture is also approached because viticulturists are facing new climate conditions and they have to adapt their busin ess in consequence. Research results have shown some changes in vine phenology during the vegetation period and also concerning grape yield and quality under various weather conditions [6, 7, 12, 14, 15].

In this context, the paper aims to evaluate the economic impact of climatic change upon grape production and its quality at Bujoru Vineyard situated in the hilly area of Eastern Romania.

2. Experimental Details

The experiments were carried out at Bujoru Research and Development Station, Galatzi County, Romania. A number of 11 vine types were used on a surface of 148 ha as follows: White Feteasca 49 ha, Royal Feteasca 12 ha, Aligote 17 ha, Sarba 11 ha for white wine grapes, Cabernet Sauvignon 5 ha, Merlot 14 ha, Black Babeasca 12 ha, Black Feteasca 1 ha for red wine grapes, Chasselas Dore: 17 ha for white table grapes, Hamburg Muscat 6 ha and Black selected Coarna 4 ha for red table grapes. The soil characteristics were : specific weight 2.65 g/cubic cm, total porosity 54.8 %, air porosity 28.5 %, hygroscopic coefficient 3.43 %, whithering coefficient 611 m^3/ha, field capacity 2,615 m^3/ha, total capacity 6,083 m^3/ha, volumetric weight 1.19 g /cm^3. The following climate factors were analyzed: global, active and useful thermic balance, annual rainfalls and also during the vegetation period, annual average temperature and also average temperature in July, August and September, air minimum temperature, maximum average in August, average temperature in the 1st and 2nd decade of June, wind speed, air moisture, nebulousness, the number of days with maximum temperatures, the length of bioactive period, the real heliothermic index, hydrothermic index, the bioclimate index of vine and oenoclimatic index. Also, the following economic indicators were studied: average and total grape production, grape quality (sugar content, the volume of 100 grape berries, grape average weight).

The following methods were used: ***Index Method*** for analyzing the variability of 22 climate characteristics (marked with X) for the period B - Control year 2007 and C - Experimental year 2008. The individual indices of climate factors were calculated and interpreted according to the formulas: $R_i = XC_i/XB_i$, where: i=1,…,22, if $R_i > 1$, i factor is increasing and if $R_i < 1$, i factor is decreasing and if $R_i = 1$, the i factor is constant ; ***Gain Method***, using the formula: $S_i = R_i - 1$, where S_i = the gain of the i climate factor and R_i, as above; if $S_i > 1$, i factor is increasing ; if $S_i < 1$, i factor is decreasing and if $S_i = 1$, the i factor is constant ; ***Share Method*** for ranking the climate factors based on their importance, using the formula : $P_i = |S_i| * 100 / \Sigma |S_i|$, where P_i = the weight of the climate factor and S_i = the gain of the climate factor; ***Point Method*** for ranking the vine types based

on the grape production and quality; ***Comparison Method*** for analyzing grape production from a year to another and among various types of vine. All the calculations have been done for 1 ha surface, but also for the whole cultivated area for each vine type.

3.Results and Discussions

3.1. Climate Factors.

The weather situation characterized by 22 main climate indicators in the year 2008 compared to the year 2007 is presented in Table 1. In the year 2008, an increased level was noticed for thermic balance, average annual temperature and also temperature in the month of August, the air minimum temperature and the average maximum temperature in August, wind speed, air relative humidity and the bioclimatic index.

Tabel 1. Individual indices, gains and shares of the climatic factors at Bujoru Research and Development Station, Galatzi

Climatic Factor	Individual index of the climatic factor	Gains, S_i	Shares, $P_{i\,\%}$
Global thermic balance (Σt°g)	1.006	0.64	0.303
Active thermic balance (Σt°a)	1.007	0.75	0.355
Useful thermic balance (Σt°u)	1.009	0.91	0.431
Σ annual rainfalls (mm)	0.515	-48.47	22.948
Σ rainfalls during the vegetation period (mm)	0.883	11.47	5.525
Σ sunstroke hours during the vegetation period	0.902	9.79	4.635
Average annual temperature,°C	1.037	3.70	1.752
Average temperature in July,°C	0.854	-14.59	6.907
Average temperature in August, °C	1.015	1.57	0.743
Average temperature in September,°C	0.982	-1.72	0.814
Air Minimum temperature,°C	1.110	7.41	3.508
Maximum average temperature in August,°C	1.045	4.58	2.168
Average temperature in the 1st and 2n decades of June	0.869	-13.10	6.020

Wind speed (km/hours)	1.304	30.43	14.407
Air relative humidity (%)	1.052	5.26	2.490
Nebulousness	1.071	7.14	3.380
Number of days with maximum temperatures > 30 °C	0.787	-21.21	10.042
The length of bioactive period, days	0.994	-0.56	0.265
The real heliothermic index	0.909	-9.09	4.304
Hydrothermic coefficient	0.857	-14.29	67.65
Bioclimatic index	1.026	2.61	1.236
Oenoclimatic index	0.982	-1.73	0.819
		$\Sigma \mid S_i \mid = 211,22$	100.00

The decreasing ranking of the climatic factors is: annual rainfalls, wind speed, the number of days with temperatures higher than 30 °C, average temperature in July and the 1st and 2nd decades of June, hydrothermic index, rainfalls during the vegetation period and heliothermic index. The other climate factors are less important.

In 2008, the annual rainfalls counted for 285.7 mm, by 50 % less than in 2007. During the vegetation period, the rainfalls reached 224. 8 mm in 2008 compared to 254.5 mm in 2007. The sunstroke counted for 1,332.7 hours compared to 1,477.4. The average temperature in July was 24 °C compared to 28.1 °C. The average temperature was 25.9 °C in August and 17.1 °C in September. The minimum temperature was –14.5 °C compared to 13 °C. The maximum temperature in August was 32 °C compared to 30.6 °C in the same month in 2007. The bioactive period has ranged between 177-178 days in the same years. The heliothermic index was 250 in 2008 compared to 275 in 2007. The hydrothermic index was 0.6 in 2008 compared to 0.6 in 2007.The bioclimatic coefficient was 11.8 in 2008 compared to 11.5 in 2007 and the oenoclimatic coefficient was 2.

3.2. Grape Yield.

Grape yield has varied by vine type but also from a year to another because of the different climate conditions (Table 2).

Tabel 2. Grape Yield by vine type in 2007 and 2008 at Bujoru Vineyard

Vine Type	Grape Yield / Position in 2007	Grape Yield / Position in 2008	Yield Gain – kg 2008-2007	Differences % 2008-2007
White Feteasca	5,307/3	8,300/7	2,993	156.39
Royal Feteasca	7,119/1	13,188/1	+6,069	185.25
Cabernet Sauvignon	2,720/9	7,650/10	+4,930	281.25
Muscat Hamburg	1,163/11	11,438/4	+10,267	983.49
Black Coarna	1,350/10	9,010/5	+7,660	667.40
Merlot	2,888/8	8,800/6	+5,912	304.70
Black Babeasca	3,677/5	7,547/11	+3,870	205.24
Black Feteasca	3,515/6	8,000/9	+4, 485	227.59
Chasselas Dore	4,000/4	13,000/2	+9,000	325.00
Aligote	6,290/2	8,200/8	+1,910	130.36
Sarba	3,500/7	11,700/3	+8,200	334.28

In the year 2007, grape yield varied between 1,163 kg ha for Hamburg Muscat type and 7,119 kg/ha for Royal Feteasca. Vine classification based on grape yield is the following one: Royal Feteasca, Aligote, White Feteasca, Chasselas Dore, Black Babeasca, Black Feteasca, Sarba, Merlot, Cabernet Sauvignon and Hamburg Muscat. In the year 2008, grape yield was higher than in 2007 for all the vine types varying between 13,188 kg/ha for Royal Feteasca and 7,547 kg/ha for Black Babeasca, reflecting a favorable influence of the climatic factors. In order, the vine type ranking in 2008: Royal Feteasca, Chasselas Dore, Hamburg Muscat, Black selected Coarna, Merlot, White Feteasca, Aligote, Black Feteasca, Cabernet Sauvignon and Black Babeasca.

3.3. Grape Production.

Grape Production has been determined both by grape yield and the cultivated area by each vine type. In the year 2007, total grape production varied between 260,043 kg at White Feteasca and 3,515 kg at Black Feteasca**.** The hierarchy of the studied types based on grape production was: White Feteasca, Aligote, Royal Feteasca, Chasselas Dore, Black Babeasca, Merlot, Sarba, Cabernet Sauvignon, Muscat Hamburg, Black Coarna Black Feteasca. In 2008, grape production varied between 406,700 kg for White Feteasca and 8,000 kg for Black Feteasca. The decreasing order of the vine types was White Feteasca, Chasselas Dore, Royal

Feteasca, Aligote, Sarba, Merlot, Black Babeasca, Hamburg Muscat, Cabernet Sauvignon, Black Coarna and Black Feteasca (Table 3).

Table 3. Grape Production by vine type in 2007 and 2008 at Bujoru Vineyard

Vine Type	Grape Production/ Position in 2007	Grape Production / Position in 2008	Production Gain – kg 2008-2007	Differences % 2008-2007
White Feteasca	260,043/1	406,700/1	+ 146,657	156.39
Royal Feteasca	85,428/3	158,000/3	+75,572	185.25
Cabernet Sauvignon	13,600/8	38,250/9	+24,650	281.25
Muscat Hamburg	6,978/9	68,620/8	+61,642	983.49
Black Coarna	5,400/10	36,040/10	+30,640	667.40
Merlot	40,432/6	123,200/6	+82,768	304.70
Black Babeasca	44,124/5	90,564/7	+46,440	205.24
Black Feteasca	3,515/11	8,000/11	+4,485	227.59
Chasselas Dore	68,000/4	221,000/2	+153,000	325.00
Aligote	106,930/2	139,400/4	32,470	130.36
Sarba	38,500/7	128,700/5	+90,200	334.28

3.4. Grape Quality

Grape quality has been analysed using the main characteristic parameters: sugar contant, acidity, weight of 100 berries, volume of 100 berries and grape average weight (Tabel 4). Compared to 2007, in 2008 **sugar content** increased by 34 g for Black Babeasca, by 10 g for Royal Feteasca, but it has remained constant for White Feteasca and decreased in case of the other types. **Acidity** increased for Cabernet Sauvignon, Black Babeasca, Hamburg Muscat, Black Coarna, Black Feteasca, Chasselas Dore, Aligote and Sarba, and decreased for Royal Feteasca and Merlot and remained constant for White Feteasca comared to the year 2007. In 2008, **the weight of 100 berries** increased for White Feteasca (+59 g), Royal Feteasca (+64 g), Hamburg Muscat (+91 g), Black Coarna (+ 74 g), Black Babeasca (+ 37 g), Chasselas Dore (+37 g) and Sarba (+ 39 g), while in case of Cabernet Sauvignon, Black Feteasca,Merlot and Aligote it registered a decrease compared to 2007. In 2008, **the volume of 100 berries** increased in case of White Feteasca alba (+ 15 m^3), Royal Feteasca (+ 34 m^3), Hamburg Muscat (+ 100 m^3), Black Coarna (+ 132 m^3), Merlot (+ 6 m^3), Chasselas Dore (+ 43 m^3) and Sarba (+

43 m^3), while for Carbernet Sauvignon, Black Feteasca, Black Babeasca and Aligote decreased compared to 2007.

Table 4. Grape Quality in 2007 and 2008 at Bujoru Vineyard

Vine type	Year	Sugar Content g/l must	Acidity g/l must H2SO4	Weight of 100 berries-g	Volume of 100 berries m^3	Average grape weight - g
White Feteasca	2007	220	3,3	79	84	90
	2008	220	3,3	120	99	90
Royal Feteasca	2007	200	4,3	89	94	89
	2008	210,4	3,64	153,4	120	92
Cabernet Sauvignon	2007	223	2,4	127	95	45
	2008	167,68	6,38	67	60	97
Hamburg Muscat	2007	229	2,35	220	200	80
	2008	195,2	3,52	311,5	300	185
Black Coarna	2007	215	2,69	200	180	102
	2008	154	3,55	274,68	312	300
Merlot	2007	231	3,64	107	82	50
	2008	214	3,30	104	88	85
Black Babeasca	2007	190	3,6	168,5	180	90
	2008	224	4,03	205,64	124	139
Black Feteasca	2007	218	2,56	153	137	59
	2008	213	2,84	97	85	152
Chasselas Dore	2007	206	2,1	120	100	54
	2008	173,2	3,14	157,93	143	103,2
Aligote	2007	212	1,98	140	122	84
	2008	175	3,98	96	92	95
Sarba	2007	243	2,79	110	90	78
	2008	202,8	4,2	149,28	133	155,4

In 2008, **the grape average weight** increased as follows: Black Coarna (+202 g), Hamburg Muscat (+105 g), Black Feteasca (+93 g), Sarba (+77 g), Cabernet Sauvignon (+ 52 g), Black Babeasca (+ 49 g), Chasselas Dore (+49 g), Merlot (+35 g), Aligote (+11 g), Royal Feteasca (+ 3 g). Only White Feteasca remained with the same grape average weight.

3.4. Vine Hierarchization according to Grape Quality

Considering the lowest number of points as the best result, meaning the highest grape quality, the hierarchy of vine types in the decreasing order is Hamburg Muscat, Black Coarna, Black Babeasca, Chasselas Dore, Sarba, Black Feteasca, White Feteasca, Royal Feteasca, Merlot, Aligote, Cabernet Sauvignon (Table 5).

Table 5. Hierarchy of Vine Types based on Grape Quality in 2008 at Bujoru Vineyard

Vine Type	Sugar Content g/l must	Acidity g/l must H2SO4	Weight of 100 berries-g	Volume of 100 berries m^3	Average grape weight g	Total points/ Position
White Feteasca	2	3	7	7	10	29/7
Royal Feteasca	5	5	5	6	9	30/8
Cabernet Sauvignon	10	9	11	11	7	48/11
Hamburg Muscat	7	4	1	2	2	16/1
Black Coarna	11	4	2	1	1	19/2
Merlot	3	3	8	9	11	34/9
Black Babeasca	1	7	3	5	5	21/3
Black Feteasca	4	1	9	10	4	28/6
Chasselas Dore	9	2	4	3	6	24/4
Aligote	8	6	10	8	8	40/10
Sarba	6	8	6	4	3	27/5

Conclusions

The weather conditions have been different in the year 2008 compared to the year 2007. An warming trend has been noticed with a direct impact upon grape yield and mainly upon grape quality.

Compared to 2007, in 2008 a higher level was registered for average annual temperature, average temperature in August, air minimum temperature, maximum average temperature in August, wind speed, air relative humidity and bioclimatic index.

The ranking of the climatic factors according to their importance is: average annual rainfalls, wind speed, number of days with maximum temperatures higher

than 30 °C, average temperature of July, the hydrothermic coefficient, the average temperature in the 1st and 2nd decades of June, rainfalls during the vegetation period, sunstroke hours, real heliothermic index, air minimum temperature, nebulousness, air relative humidity, average temperature in August, annual average temperature, bioclimatic index.

In the year 2008, grape yield was higher than in 2007 for all the vine types varying between 7,547 kg/ha for Black Babeasca and 13,188 kg/ha for Royal Feteasca. Total grape production was also higher, the production gain varying between 883 % for Hamburg Muscat and 30 % for Aligote.

In climate factors of the year 2008 an increased acidity, grape weight and volume, but a decrease in sugar content for almost all the vine types (Black Babeasca, Royal Feteasca, White Feteasca, Hamburg Muscat, Black Coarna, Chasselass Dore, Merlot).

Climate change has to be taken into consideration concerning grape production and quality in close relation to vine type.

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INFLUENCE OF THE SOWING TIME ON GROWING AND DEVELOPMENT OF SOME SWEET CORN HYBRIDS IN DIFFERENT LOCATIONS FROM ROMANIA

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Abstract. The results presented the influence of sowing time on growth and development of sweet corn hybrids. Planting dates was determined according to experimental variations. For the first time to be considered when soil temperature was 8-10 ^{0}C. The most important phenophases of sweet corn growth and development have triggered differently depending on planting dates, location and hybrid. Romanian hybrids were better adapted to environmental conditions at the beginning of the vegetation is causing rising earlier than 2-6 days compared to foreign hybrids. Number of days required for each phenophases occurrence decreased continuously from the first time to third sowing time.

Key words: *Zea mays*, var. *rugosa* (Bonaf), convar. *Saccharata* Koprn (Sturt.), anthesis, silk emergence

Introduction

Sweet corn, *Zea mays*, var. *rugosa* (Bonaf),convar. Saccharata Koprn (Sturt) is native to submountainous area of Peru and Bolivia, where it arose soft corn grain. As a secondary center is Mexico, where southern indians, brought soft corn grain. Under the arid climatic conditions it appears the new type of corn with hard grain. Later, under repeated natural crosses appeared multiple forms like indurata, indentata and saccharata [1].

On the American continent sweet corn was made known over 3000 years ago. After discovery of America, was brought to Europe where it spread in all countries of the continent.

Sweet corn is grown for its milk stage grain. In this phenophase taste qualities are maximum and nutritious substances are best absorbed by human organism.

Sweet corn is a monoecious plant, which form at the tip of the stem a male branched panicle type inflorescence and at the armpit of the leaves it forms the female spadix

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type inflorescences, called ears, covered with leaves (corn husks). A feature of many sweet corn hybrids is the ability to form shoots that may have ears.
This species has high demands to the factors of vegetation, especially to temperature and humidity. If the first period of vegetation, from seed emergence to anthesis, the most important growth factor is temperature, witch can speed up growth if is at optimum values. After anthesis the most important factor of vegetation becomes the humidity. High humidity during flowering and grain formation is crucial in achieving high yields of sweet corn.
Sweet corn is considered to be a real source of food, witch has proved to have a high caloric content and nutritional value compared to the usual corn. Fresh or preserved, provides a real vitamin, mineral and energy intake, and is an important source of micronutrients, especially magnesium (48mg/100g grains), which is usually missing from other vegetable products [2]. The energy value of sweet corn is 370 kJ/100g grains, being higher than green peas. Technological maturity, seeds contain 25-27% dry matter, 14-15% carbohydrates, 5-5,5% protein, 0,75% fat, aminoacids, significant amounts of vitamins: C, B, PP, E and minerals (K, P, Ca, Mg, Fe). [3].
Sweet corn is used in food industry as raw material for canning, but it is also eaten fresh in the milk stage as boiled corn or in the preparation of different corn mashes, garnishes for steaks, stewed fruits, cream-soups of corn and flour from sugar corn is in the composition of various pastries [1, 4].
The sweet corn culture in our country began to expand much later, one of the reasons being that the population used and is still using in consumption corn cultivars for grain that is consumed in the milk stage as boiled or fried corn.
Since lately, sweet corn began to sell in supermarkets, as fresh or preserved vegetable and the fact that this product is known and appreciated by the buyers, explains the need for further studies on the development of technological measures to allow expansion of the culture in Romania.
The paper presents results regarding the influence of hybrid and sowing time on growth and development of the plants.

Material And Methods

Experience was held in 2011 in two sites: Luduş, Mureş, county and Dâlga, Călăraşi county (table 1).
The biological material was represented by two Romanian hybrids: Deliciul verii and Prima and two foreign hybrids: Boston and H 702.
During the experiment, it was realized many observations, measurements and determinations, which were used specific working methods namely:

- Morphometric determinations (plant height, height of the first ear insertion point), on the variants and repetitions. It was made observations and determinations on 10 plants in 4 repetitions.

- Phenological determinations: sowing date, date of emerging, date of anthesis and date of silk emergence.

The technology used in the experiences was selected from the literature for sweet corn [2, 3].
Sweet corn harvesting occurs when they reach the maturity stage of consumption (milk-wax stage) when the cob is hard, well covered by leaves, and silk became brown and dry.

Table 1) The organization of experience

Experience	Hybrid	Location	Sowing time	Technological features		
				Method	Planting scheme (cm)	Density
Influence of the sowing time on growing and development of some sweet corn hybrids in different locations	Prima Deliciul verii Boston 702	LUDUŞ	I* - 24.IV	sown directly	70/24	60.000
			II -10.V			
			III – 17.V			
	Prima Deliciul verii Boston 702	DÂLGA	I*- 7. IV			
			II – 19.IV			
			III – 27.IV			

* sowing when the soil temperature has reached 8 - 10^0 C;

Results And Discussion

From meteorological data presented in figure 1, we can see that in Dâlga from november to august there were lowest temperatures in January (- 3,6 ^{0}C) and the warmest period was in July (25 ^{0}C).
Concerning the hydric regime can be observed that the dry month was March (2 mm) and the precipitation was highest in May (98.3 mm). It can be noted that during November 2010 to August 2011 was favorable hydric regime, providing enough water which helped for good soil preparation for sowing in the spring. Although March showed no precipitation, in April, May and June, hydric regime was favorable for growing sweet corn. However, we can see that in the early growing season, temperatures recorded were quite low, causing a slight stress which affected the processes of seed emergence and young plants growth.

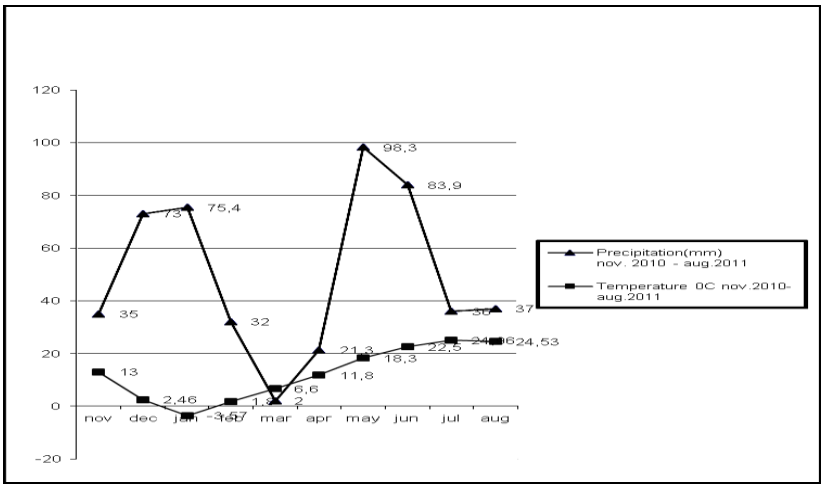


Figure 1. Weather conditions for Dâlga during nov. 2010-aug. 2011

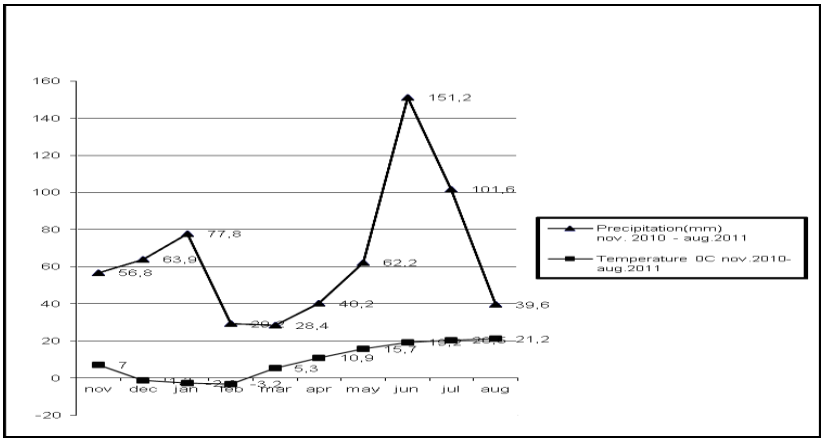


Figure 2. Weather conditions for Luduş during nov. 2010-aug. 2011

From meteorological data presented in Figure 2, it can be seen that in the Luduş area, from November 2010 to August 2011, the lowest monthly average temperatures were registered in February (-3.2 ^{0}C) and the warmest period was in August (21.2 ^{0}C).

In the hydric regime, we can observe that the month with the lowest precipitation was March (28.4 mm) and the highest precipitation was in June (151.2 mm). In the hydric regime, we can observe that the month with the lowest precipitation was March (28.4 mm), and the highest precipitation was in June (151.2 mm). It can be noted so that during November 2010 – January 2011 the hydric regime was favorable for good preparation of soil in the spring for sowing.

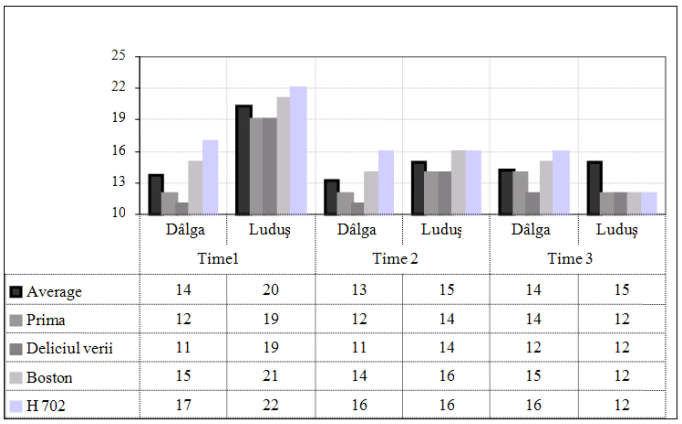
Concerning the influence of the time of sowing on the plant growing and development of the four corn hybrids which were taken for study in both locations (Luduş and Dâlga), it can be seen that the main climate factor which affect the number of days necessary for each phenophase is temperature (Table 2, 3, Figure 3 - 7). It may be noted that increased temperatures shortens the period until the appearance of the major phenophases: emergence, anthesis, silk emergence, harvesting stage.

Table 2) Results on the influence of sowing time on the development phenophases of sweet corn - Dâlga 2011

Hybrid	No. of days from sowing to emergence			No. of days from sowing to anthesis			No. of days from sowing to silk emergence			No. of days from sowing to harvest			Vegetation period		
	Time			Time			Time			Time			Time		
	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III
Average	14	13	18	73	61	58	79	68	64	110	98	93	96	85	76
Prima	12	12	17	71	59	54	75	63	58	107	95	90	95	83	73
Deliciul verii	11	11	15	67	57	54	72	62	57	107	95	90	96	84	75
Boston	15	14	18	71	59	58	74	63	62	107	95	90	92	81	72
H 702	17	16	19	81	69	67	95	83	80	118	106	101	101	90	82

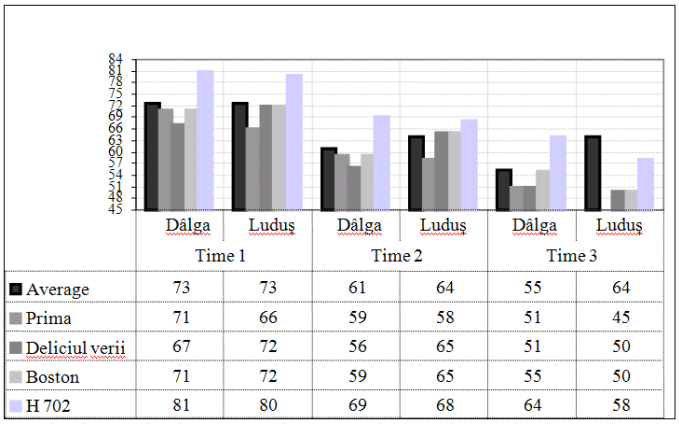
Tabel 3) Results on the influence of sowing time on the development phenophases of sweet corn – Luduş -2011

Hybrid	No. of days from sowing to emergence			No. of days from sowing to anthesis			No. of days from sowing to silk emergence			No. of days from sowing to harvest			Vegetation period		
	Time			Time			Time			Time			Time		
	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III
Average	21	15	12	74	64	62	76	66	64	97	88	85	76	73	73
Prima	20	14	12	68	57	59	71	60	60	91	81	81	71	67	69
Deliciul verii	20	14	12	73	65	62	75	66	63	96	88	84	76	74	72
Boston	22	16	12	73	65	63	75	67	64	96	89	85	74	73	73
H 702	23	16	12	81	68	65	83	70	67	104	92	88	81	76	76



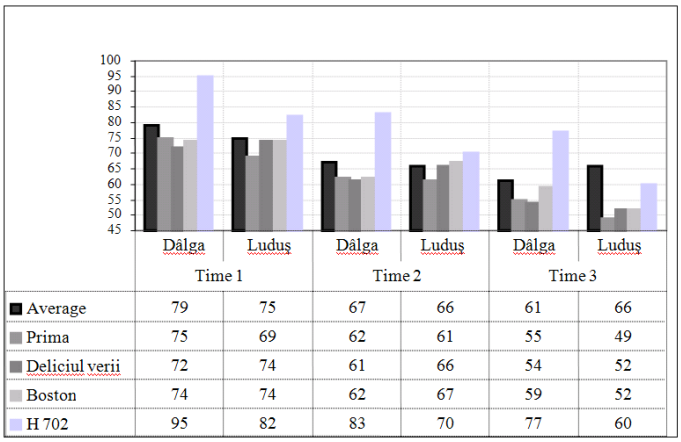
	Dâlga	Luduş	Dâlga	Luduş	Dâlga	Luduş
	Time1		Time 2		Time 3	
Average	14	20	13	15	14	15
Prima	12	19	12	14	14	12
Deliciul verii	11	19	11	14	12	12
Boston	15	21	14	16	15	12
H 702	17	22	16	16	16	12

Figure 3. Number of days from sowing to emergence



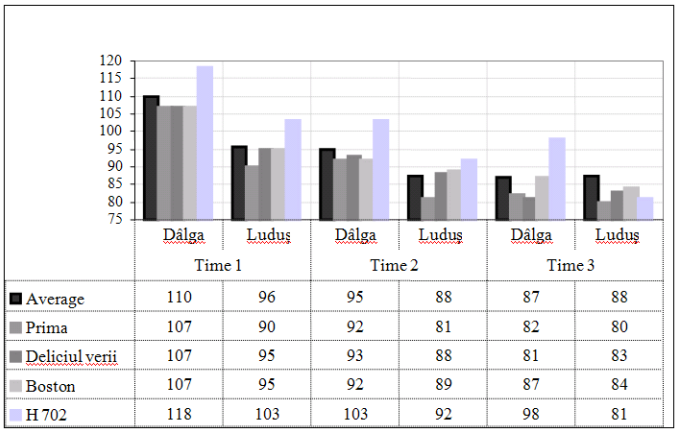
	Dâlga	Luduş	Dâlga	Luduş	Dâlga	Luduş
	Time 1		Time 2		Time 3	
Average	73	73	61	64	55	64
Prima	71	66	59	58	51	45
Deliciul verii	67	72	56	65	51	50
Boston	71	72	59	65	55	50
H 702	81	80	69	68	64	58

Figure 4 Number of days from sowing to anthesis



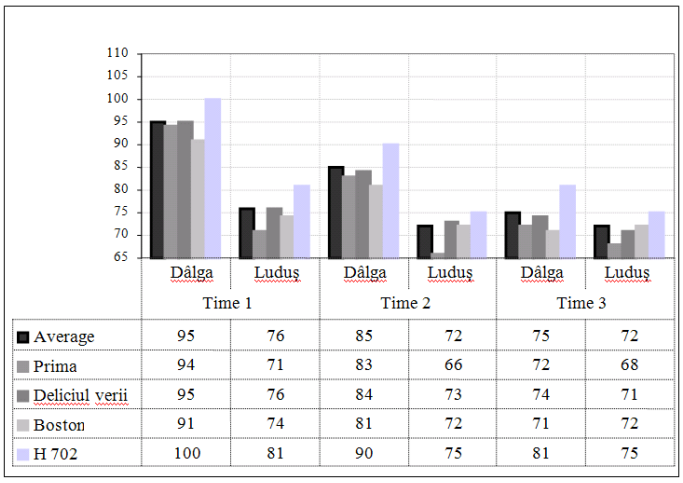
	Dâlga	Luduş	Dâlga	Luduş	Dâlga	Luduş
	Time 1		Time 2		Time 3	
Average	79	75	67	66	61	66
Prima	75	69	62	61	55	49
Deliciul verii	72	74	61	66	54	52
Boston	74	74	62	67	59	52
H 702	95	82	83	70	77	60

Figure 5 Number of days from sowing to silk emergence



	Time 1		Time 2		Time 3	
	Dâlga	Luduş	Dâlga	Luduş	Dâlga	Luduş
Average	110	96	95	88	87	88
Prima	107	90	92	81	82	80
Deliciul verii	107	95	93	88	81	83
Boston	107	95	92	89	87	84
H 702	118	103	103	92	98	81

Figure 6 Number of days from sowing to harvest



	Time 1		Time 2		Time 3	
	Dâlga	Luduş	Dâlga	Luduş	Dâlga	Luduş
Average	95	76	85	72	75	72
Prima	94	71	83	66	72	68
Deliciul verii	95	76	84	73	74	71
Boston	91	74	81	72	71	72
H 702	100	81	90	75	81	75

Figure 7 Vegetation period

At Dâlga in the first time of sowing (07.IV.2011), romanian hybrids Prima and Deliciul verii have sprung 2 or 3 days earlier than average of the experience, while the foreign hybrids (Boston and H 702) have sprung up with 1- 3 days laterthan the average. For the other two time of sowing (19.IV and 24.IV) the situation is similar. In the second time of sowing Romanian hybrids have sprung up with 1 or 2 days earlier and foreign hybrids emerge 1 or 3 days later than the average. In the third time of sowing the situation was similar, but the emergence for Prima occured after 17 days from sowing, like the average.

Between anthesis and silk emergence it was only few days, depending by the sowing time and hybrid. The periods from sowing to anthesis and to silk emergence were gradually reduced from first sowing time to second and to third sowing time.

Concerning the vegetation period and the number of days from sowing to harvesting it can be observed that in all sowing time the hybrid H 702 is the latest one. The vegetation period of H 702 ranged from 82-101 days depending on sowing time, all other hybrids being below average values.
At Luduş, emergence occurred at 20 days from sowing for Romanian hybrids, 22 days for Boston and 23 days for H 702. In the second sowing time Romanian varieties shave sprung up in 14 days, one day earlier than average and foreign ones in 16 days, one day later than average experience. In the third sowing time, because optimal conditions of temperature the hybrids behaved similarly and emergence occur in 12 days.
Further, in the other phenophases it can be seen that the length of period needed to reach each phenophase gradually decreased in every sowing time. It can be seen that the hybrid H 702 is later than the other hybrids, with a vegetation period from 76-81 days depending on sowing time.

Influence of planting time on plant growth - Dâlga area (table 4)
It can be noticed that plant height varies depending on sowing time.
The experience average for first sowing time was 199.6 cm. The highest value was recorded at H 702 (242.6 cm) and lowest one in Deliciul verii (180 cm). In the second sowing time the average value was of 195.5 cm, and the highest value was recorded at H 702 (244.0 cm) and the lowest one was in Deliciul verii (173.1 cm). At the third time we have an average of 191, cm, the highest value was recorded also at H 702 (243.5 cm) and lowest in Deliciul verii (170.7 cm).
Ear insertion height averages increased from the first time since the last one (60.1 to 66 cm). The greatest height was recorded in third sowing time at H 702 (84.0 cm) which exceeded the average with 18 cm. The lowest height was at Prima in the first sowing time (49.3 cm), 10,3 cm below experience average.
Also at the number of leaves per plant can be observed the same trend of declining average values from the first to third sowing time (10.5 to 10.3).

Table 4 Results on the influence of hybrid on the growing of the plants, Dâlga - 2011

Hybrid	Average height (cm)			Insertion height (cm)			No. of leaves /plant		
	Time			Time			Time		
	I	II	III	I	II	III	I	II	III
Averege	199,6	195,5	191,1	60,1	63,5	66,0	10,5	10,4	10,3
Prima	186,7	181,2	175,9	49,3	51,3	63,3	10,3	10,2	10,1
Deliciul verii	180,0	173,1	170,7	56,0	60,5	52,3	10,3	10,3	10,1
Boston	189,1	183,8	174,2	61,9	64,3	64,5	10,5	10,5	10,3
H 702	242,6	244,0	243,5	73,0	77,9	84,0	10,8	10,8	10,5

The analysis of the average values for the plant height at Luduş (Table 5) shows that these values varies discontinuously, the highest value being observed in the second sowing time (186,3), H 702 has the highest value (220,3 cm) in the second sowing time, above the average of 34 cm. The lowest value was given by Prima at first sowing time (133,3 cm). The height of insertion average of ear varies continuously and increasing from the first sowing time to one (49 to 55,6). The highest value was obtained by H 702 in third sowing time (77,0) exceeded control (average) by 21,4 cm.

The lowest height was at Prima in the first sowing time (40,5 cm), 8,5 cm below average.

In the number of leaves per plant can be observed that the average values vary discontinuously with the maximum value on the second sowing time.

Table 5 Results on the influence of hybrid on the growing of the plants, Luduş - 2011

Hybrids	Average height (cm)			Insertion height (cm)			No. of leaves /plant		
	Time			Time			Time		
	I	II	III	I	II	III	I	II	III
Average	167,3	186,3	177,8	49,0	52,8	55,6	10,2	10,3	10,2
Prima	133,3	178,0	170,5	40,5	44,3	47,0	10,0	10,0	10,0
Deliciul verii	153,8	164,5	159,5	41,8	45,0	47,3	10,0	10,2	10,1
Boston	171,0	182,5	170,5	42,8	45,8	51,0	10,3	10,3	10,2
H 702	211,3	220,3	210,5	71,0	76,0	77,0	10,5	10,5	10,3

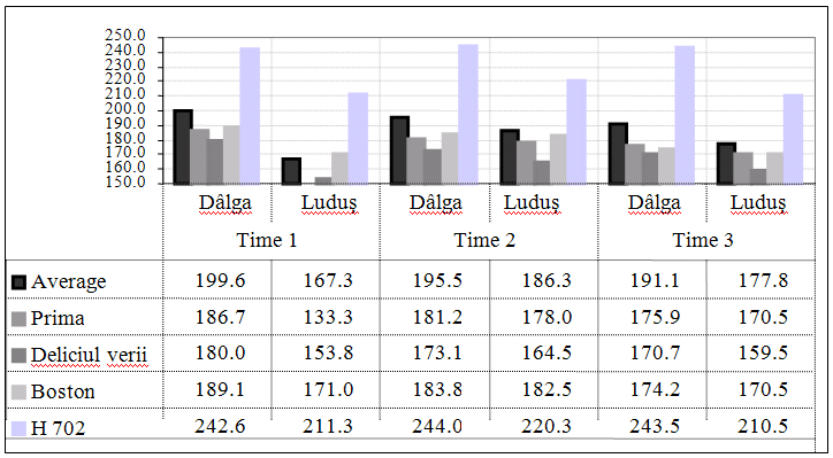


Figure 8 Average height (cm)

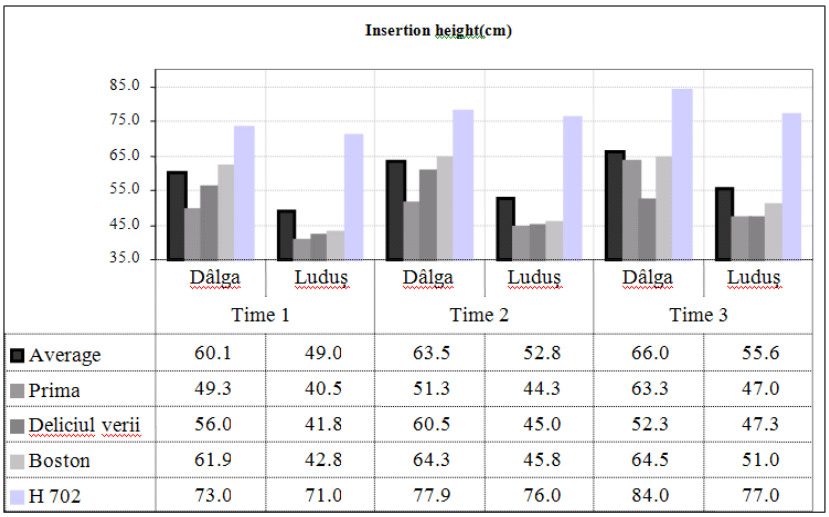


Figure 9 Insertion height (cm)

Table 6 Morphometric characteristics of ears for different hybrids of sweet corn – Dâlga 2011

Hybrids	Number of ears per plant			Ear length (cm)			Ear diameter (cm)			Number of rows			Number of grains /row		
	Time			Time			Time			Time			Time		
	I	II	III	I	II		I	II	III	I	II		I	II	III
Average	1.2	1.2	1.1	19	19	18	4.8	4.9	4.7	16	17	16	38	41	38
Prima	1.3	1.3	1.1	17	18	17	4.2	4.4	4.4	10	12	12	36	38	32
Deliciul verii	1.2	1.2	1.1	19	19	19	4.8	4.9	4.4	14	16	14	42	43	42
Boston	1.0	1.1	1.1	19	19	18	5.0	5.0	5.1	18	18	17	34	40	36
H 702	1.2	1.3	1.2	19	20	19	5.1	5.2	5.1	20	20	20	40	41	40

At Dâlga the average values for number of ears per plant varied in lower limits, between 1.1 to 1.2. The lowest values were recorded in Boston at first sowing time (table 6). The highest value of the ears length was made in the second sowing time for H 702 (20cm). Diameter of the ears varied strong enough with a minimum of 4,2 cm for Prima at the first sowing time and maximum was 5,2 cm in second sowing time at H 702. The number of rows of grains/cob varies from 10 to 20 the minimum was at first sowing time on Prima and the maximum on H 702. Number of grains per row ranged from 32 (Prima, third time) to 43 (Deliciul verii, second time).

Table 7 Morphometric characteristics of ears for different hybrids of sweet corn – Luduş 2011

Hybrids	Number of ears per plant			Ear length (cm)			Ear diameter (cm)			Number of rows			Number of grains /row		
	Time			Time			Time			Time			Time		
	I	II	III	I	II		I	II	III	I	II		I	II	III
Average	1.1	1.1	1.2	19	18	19	4.3	4.0	4.0	16	16	16	39	38	39
Prima	1.1	1.0	1.2	17	16	17	4.0	4.0	4.0	12	12	12	37	36	36
Deliciul verii	1.1	1.1	1.2	18	16	18	5.0	4.0	4.0	16	16	14	38	36	43
Boston	1.1	1.2	1.2	20	19	20	4.0	4.0	4.0	16	16	16	38	36	37
H 702	1.0	1.3	1.3	21	20	21	4.0	4.0	4.0	21	20	21	42	43	41

At Luduş number of ears per plant varied between 1,0 to 1,3 (average). The lowest values were reported for Prima hybrid (second time), H 702 (first time) (table 7). The highest value in the length of the ears was performed by H 702 (21cm). The diameter of the ears varied strong enough from 4,0 to 5,0 cm, the highest value was at Deliciul verii at first sowing time. Number of rows varies from 12 to 21 the minimum value was registered at Prima and maximum at H 702. Number of grains per row varied from 36 (Prima) to 43 (Deliciul verii, third time and H 702, second time).

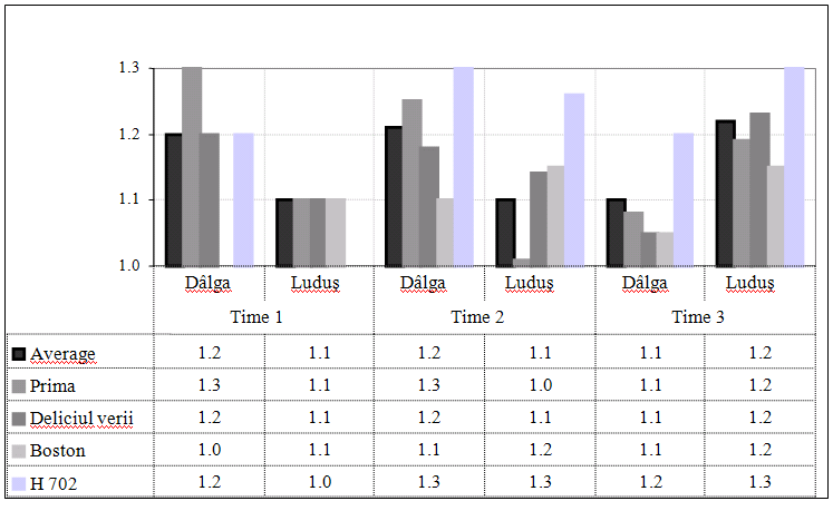
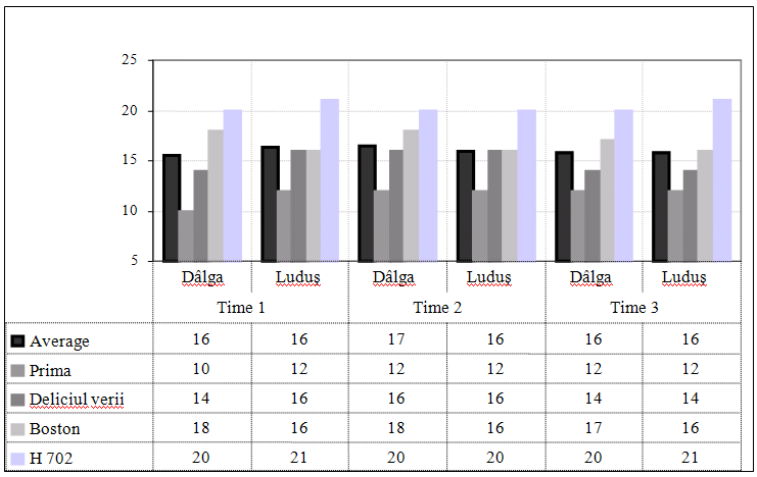


Figure 11 Number of ears per plant.



	Dâlga	Luduş	Dâlga	Luduş	Dâlga	Luduş
	Time 1		Time 2		Time 3	
Average	16	16	17	16	16	16
Prima	10	12	12	12	12	12
Deliciul verii	14	16	16	16	14	14
Boston	18	16	18	16	17	16
H 702	20	21	20	20	20	21

Figure 12 Number of grains/row

Conclusions

Concerning the influence of the sowing time on the plant growing and development of the four corn hybrids which were taken for study in both locations (Luduş and Dâlga), it can be seen that the main climate factor which affect the number of days necessary for each phenophase is temperature. It may be noted that increased temperatures shortens the period until the appearance of the major phenophases: emergence, anthesis, silk emergence, harvesting stage.

Romanian hybrids were better adapted to environmental conditions at the beginning of the vegetation period, occurring earlier emergence with 2-6 days compared to hybrids of foreign hybrids.

Planting dates also influenced total plant height values and ear insertion height.

The number of ears per plant varied from 1,0 to 1,3 for the two locations. The data presented in the results shows that there is a direct and inverse relationship between number of ears per plant and size of ears.

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INFLUENCE OF SOWING TIME AND GROWING AREA OF PRODUCTIVE POTENTIAL OF SWEET CORN HYBRIDS

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Antonia IVAŞCU[3], Teodor Dan ENESCU[4]

Abstract. The results presented in this paper shows the influence of sowing time on the production potential of same sweet corn hybrids. Planting dates was determined according to experimental variations. For the first sowing time be considered when soil temperature was 8-10^{0}C. The highest yield was recorded in hybrid 702, in all planting dates. Local hybrids were ears of lower size compared with the foreign hybrids, but have made many ears per plant. Foreign hybrids have proved superior to Romanian ones, with larger share of the mass of the cobs without leaves from the total mass of the ears.

Key words: *Zea mays*, var. *rugosa (Bonaf)*, convar. *Saccharata* Koprn (Sturt.), cob, Luduş, Dâlga.

Introduction

Sweet corn (Zea mays L. saccharata Korn) is one of the most popular vegetable crops popular in the United States and Canada [1]. In recent years witnessed a growing spread in the Southern Pacific [2].

States that sweet corn is one of the most popular vegetables in the U.S. market, ranking second in consumption after tomato and seventh as a ratio between all fresh vegetables. [3]
Sweet corn differs from other types of corn by the presence of a gene or genes that alter starch synthesis in endosperm [4].
The edible part of this plant is immature grain consists of endosperm and ovary wall and genes that distinguish the sweet corn by usually corn affects just those tissues *(su1, su2, ae, bt, bt2, du, sh2, se , sb, shz)* Sugar is the main component of taste for sweet corn. Taste is also determined by flavor, especially the bouquet you have sweet corn during boiling.
Sweet corn is a real source of food for the human diet was observed with higher caloric content and high nutritional value compared to regular corn. Used as fresh or preserved, providing a real vitamin, mineral and energy intake, an important source of magnesium (48mg/100g beans). This food is also an important source of micronutrients, a food rich in magnesium (48mg/100 g edible items), usually

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missing from other vegetable. Energy value of sweet corn is 370 kJ, being higher than green peas. The technological maturity, seeds contain 25-27% dry matter, 14-15% carbohydrates, 5-5.5% protein, 0.75% fat, amino acids (tryptophan and lysine), significant amounts of vitamins: C, B complex, PP, E and mineral elements (K, P, Ca, Mg, Fe) [6].

Sweet corn is used in industry as raw material for canned food, but also for fresh market at milk stage, boiled or used for the preparation of different smoothies, gaskets for steaks, compotes, cream of corn soup, sweet corn and cornmeal enter ingredient of many pastries [6] [7].

Sweet corn is one of the most popular vegetables in the U.S. market, ranking second in consumption after tomato and seventh as a percentage between eating raw vegetables [3]. Annually, in the U.S. 226 hectares are planted with sweet corn and turnover resulting from the marketing of the product is over 180 million dollars. This culture is also very popular in Japan, Taiwan, South Korea, which occupies over 20,000 hectares. In Europe, significant areas are cultivated in France (17,100 ha), Italy (4800 ha) and Spain (2,100 ha).

In our country sweet corn began to grow much later and the fact that people used cultivars of corn grain consumption, which is consumed during milk - wax, boiled or fried.

Recently, sweet corn began to be sold in supermarkets as fresh or preserved vegetable and because this product is known and appreciated by customers, explains the need for further studies on the development of technological measures to allow expansion culture in Romania.

The paper presents results on the influence of sowing time and hybrid on productive potential of sweet corn.

Material And Methods

Experience was held in 2011 in two sites:, Dâlga, Călăraşi county, and Luduş, Mureş county. The biological material was represented by two Romanian hybrids: Deliciul verii and Prima and two foreign hybrids: Boston and H 702 (Table 1).

Table 1 The organization of experience

Experience	Hybrid	Location	Sowing time	Technological features		
				Method	Planting scheme (cm)	Density
Influence of the sowing time on growing and development of some sweet corn hybrids in different locations	Prima Deliciul verii Boston 702	LUDUŞ	I* - 24.IV	sown directly	70/24	60.000
			II -10.V			
			III – 17.V			
	Prima Deliciul verii Boston 702	DÂLGA	I*- 7. IV			
			II – 19.IV			
			III – 27.IV			

* sowing when the soil temperature has reached 8 - 10^0 C;

During the experiment, it was realized many observations, measurements and determinations, which were used specific working methods namely:

- Morphometric determinations (plant height, height of the first ear insertion point), on the variants and repetions. It was made observations and determinations on 10 plants in 4 repetitions.

- Phenological determinations: sowing date, date of emerging, date of anthesis and date of silk emergence.

- Production potential was determined by recording the number of ears formed per plant, their average mass and calculate the average production per plants/ ha, for each variant studied. The results were interpreted statistically by analysis of variance.

The technology used in the experiences was selected from the literature for sweet corn [5,7], except the time of sowing which was differentiated according to experimental variants.
Culture was established by sowing, when the soil temperature has reached 8 to 10^0 C. Density used was 60.000 plants/ha. Sweet corn harvesting occurs when they reach the maturity stage of consumption (milk-wax stage) when the cob is hard, well covered by leaves, and silk became brown and dry.

Results And Discussion

From meteorological data presented in figure 1, we can see that in Dâlga from november to august there were lowest temperatures in January (- 3,6 ^{0}C) and the warmest period was in July (25 ^{0}C).

Concerning the hydric regime can be observed that the dry month was March (2 mm) and the precipitation was highest in May (98, 3 mm). It can be noted that during November 2010 to August 2011 was favorable hydric regime, providing enough water which helped for good soil preparation for sowing in the spring. Although March showed no precipitation, in April, May and June, hydric regime was favorable for growing sweet corn. However, we can see that in the early growing season, temperatures recorded were quite low, causing a slight stress which affected the processes of seed emergence and young plants growth.

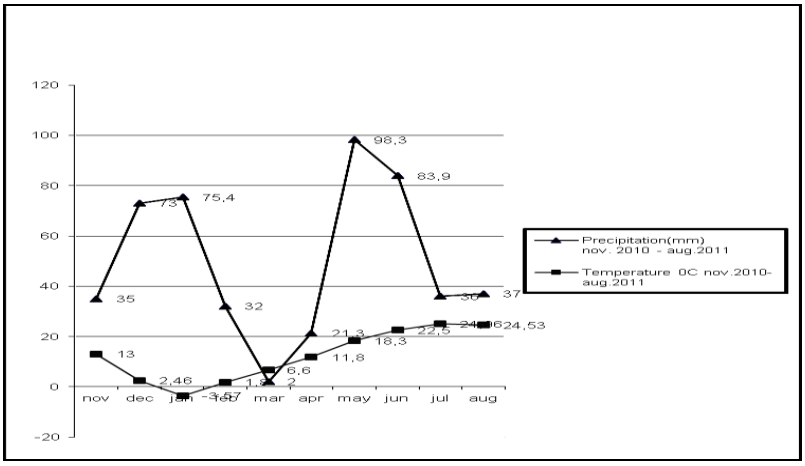

Fig. 1. Weather conditions for Dâlga during nov. 2010-aug. 2011

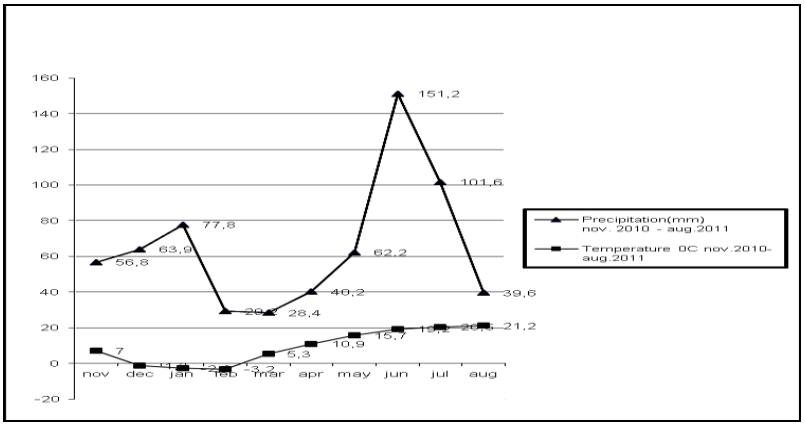

Fig. 2. Weather conditions for Luduş during nov. 2010-aug. 2011

From meteorological data presented in Figure 1.1 it can be seen that in the Luduş area, from November 2010 to August 2011, the lowest monthly average temperatures were registered in February (-3,2 ^{0}C) and the warmest period was in August (21,2 ^{0}C).

In the hydric regime, we can observe that the month with the lowest precipitation was March (28, 4 mm) and the highest precipitation was in June (151,2 mm). In the hydric regime, we can observe that the month with the lowest precipitation was March (28, 4 mm), and the highest precipitation was in June (151.2 mm). It can be noted so that during November 2010 – January 2011 the hydric regime was favorable for good preparation of soil in the spring for sowing.

As shown in table 2, the climatic conditions of 2011, at Dâlga - Călăraşi, there was an average weight of the ears of 291g (sowing time I), 316g (sowing time II) and 250g (sowing time III). Foreign hybrids had a higher average mass of the ear than Romanian hybrids. The first hybrid was H 702 with 314g (sowing time I), 367g (sowing time II), 282 g (sowing time III), above the average of 8%, 16%, respectively 13%, and the last one was Prima.

Hybrids studied were differentiated by weight components of the ear from the total mass. The foreign hybrids was better than Romanian ones, with higher percentage of the ear without sheets weight from the total weight of the ear (79-80%), with differences of 2 to 3% from the average experience (time I), 80% of the total, with differences 2% from the average experience (time II), 77-79% of the total, with differences of 1-3% from the average experience (time III).

Accordingly, in these hybrids it was found the lowest percentage the ear leaves (sheets, pannus), representing 20-23% by weight, depending on the time compared to 23 to 27% in local hybrids.

Tabelul 2) The influence of sowing time on the weight of ears at sweet corn Dâlga 2011

Hybrid	**The average weight of ear(g)**					**The average weight**
	Total ear+covering leaves	**Of which**				
		ear		**covering leaves**		
	g	**g**	**%**	**g**	**%**	**kg/pl.**
Time I						
Average	291	226	77	65	23	0.3
Prima	244	180	74	64	26	0.3
Deliciul verii	299	228	76	71	24	0.3
Boston	305	244	80	61	20	0.3
H 702	314	249	79	65	21	0.4
Time II						
Average	316	254	78	64	22	0.4
Prima	266	202	76	44	24	0.3
Deliciul verii	349	270	77	79	23	0.4
Boston	310	249	80	61	20	0.3
H 702	367	294	80	73	20	0.5

Time III						
Average	250	192	76	59	24	0.3
Prima	229	168	74	61	27	0.2
Deliciul verii	247	188	76	59	24	0.3
Boston	243	187	77	56	23	0.3
H 702	282	223	79	59	21	0.3

As shown in Table 3, in the climatic conditions of 2011, the Luduş- Mureş County, there was a total average cobs weight of 323g (time I), 370g (time II) and 355g (time III). Foreign hybrids had a higher average mass of the native ear. The first hybrid was H 702 with 342g (sowing time I), 400g (time II), 390 g (time III), 5.9% above the average, 8, 1%, respectively 9,8%.
Hybrids studied were differentiated by weight components of the ear to its total mass. The foreign hybrids was better than Romanian ones, with higher percentage of the ear without sheets weight from the total weight of the ear (76-79%) of the total weight, with differences of 3% from the average experience (time I).
Hybrids showed a 21-27% share of the ear sheets (time I) of the total mass, with an average of 24%, foreign hybrid H 702 showed the lowest value of 21% and the highest value recorded at Prima, 27%.

Tabelul 3) The influence of sowing time on the weight of ears at sweet corn - Luduş 2011

Hybrid	**The average weight of ear(g)**					**The average weight**
	Total ear + covering leaves	**Of which**				
		ear		**covering leaves**		
	g.	**g**	**%**	**g.**	**%**	**kg/pl.**
Time I						
Average	323	248	76	76	24	0.3
Prima	300	220	73	80	27	0.3
Deliciul verii	320	240	75	80	25	0.3
Boston	330	250	76	80	24	0.4
H 702	342	270	79	72	21	0.4
Time II						
Average	370	255	69	115	31	0.4
Prima	340	240	71	100	29	0.3
Deliciul verii	360	240	67	120	33	0.4
Boston	380	260	68	120	31	0.4
H 702	400	280	70	120	30	0.5
Time III						
Average	355	275	77	80	23	0.4
Prima	330	250	76	80	24	0.4
Deliciul verii	340	270	79	70	21	0.4
Boston	360	280	78	80	22	0.4
H 702	390	300	77	90	23	0.5

In the experimental conditions at Dâlga, at first sowing time for all hybrids cobs production ranged from 18,472 to 21,817 kg/ha, with an average of 19,907 kg/ha (table 4). Were observed with the highest production values hybrid 702 (21,817 kg/ha), followed by hybrid Prima (20,755 kg/ha).
In the second sowing time cobs production ranged from 19,966 to 28,634 kg/ha, with an average of 23441 kg/ha (table 4). Were observed with the highest production values hybrid 702 (28,634 kg/ha), followed by Deliciul verii (24,703 kg/ha).
In the third sowing time cobs production ranged from 14,820 to 20,280 kg /ha, with an average of 16.488kg/ha. Were observed with the highest production values hybrid 702 (20,280 kg/ha), followed by Deliciul verii (15,540 kg/ha).

Table 4) Synthesis of production results in some sweet corn Dâlga 2011

Hybrids	**The average production-kg/ha**			**Signification**		
	Time I	**Time II**	**Time III**	**Time I**	**Time II**	**Time III**
Average	19907	23441	16488	-	-	-
Prima	20755	19966	14820		0	00
Deliciul verii	18583	24703	15540			0
Boston	18472	20462	15310			00
H 702	21817	28634	20280	*	**	***
DL 5%	1672,8 - 8,40%	3019,9 - 12,88%	705,3 - 4,28%			
DL 1%	2774,3 - 13,94%	5008,6 - 21,37%	1169,8 - 7,10%			
DL 0,1%	5188,3 26,06%	9366,7 - 39,96%	2187,7 - 13,27%			

In the experimental conditions of the Luduş, at first sowing time, cobs production ranged from 19,114 to 21,411 kg / ha, with an average of 20,634 kg / ha (table 5/fig.3). Were observed with the highest production values hybrid 702 (21. 411), followed by Boston (21,038 kg/ha).
In the second sowing time, cobs production ranged from 20,576 to 29,359 kg/ha, with an average of 24,970 kg/ha. There were observed with the highest production values hybrid 702 (29,359 kg/ha), followed by Boston (25.560 kg/ha).
In the third sowing time, cobs production ranged from 23,580 to 30,379 kg /ha, with an average of 25,921 kg/ha (Table 5/fig. 3). Were observed with the highest production values at hybrid 702 (30,379 kg/ha), followed by Deliciul verii (25,136 kg/ha).

Tabelul 5) Synthesis of production results in some sweet corn – Luduş 2011

Hybrid	Producţia medie-kg/ha			Semnificatii		
	Time I	Time II	Time III	Time I	Time II	Time III
Average	20634	24970	25921			
Prima	19114	20576	23580	000	000	0
Deliciul verii	20973	24401	25136			
Boston	21038	25560	24766	*		
H 702	21411	29359	30379	**	***	**
DL 5%	383,8 - 1,86%	972,1 - 3,89%	1958,9 - 7,56%			
DL 1%	636,6 - 3,09%	1612,3 - 6,46%	3248,8 - 12,53%			
DL 0,1%	1190,5 - 5,77%	3015,1 - 12,08%	6075,7 - 23,44%			

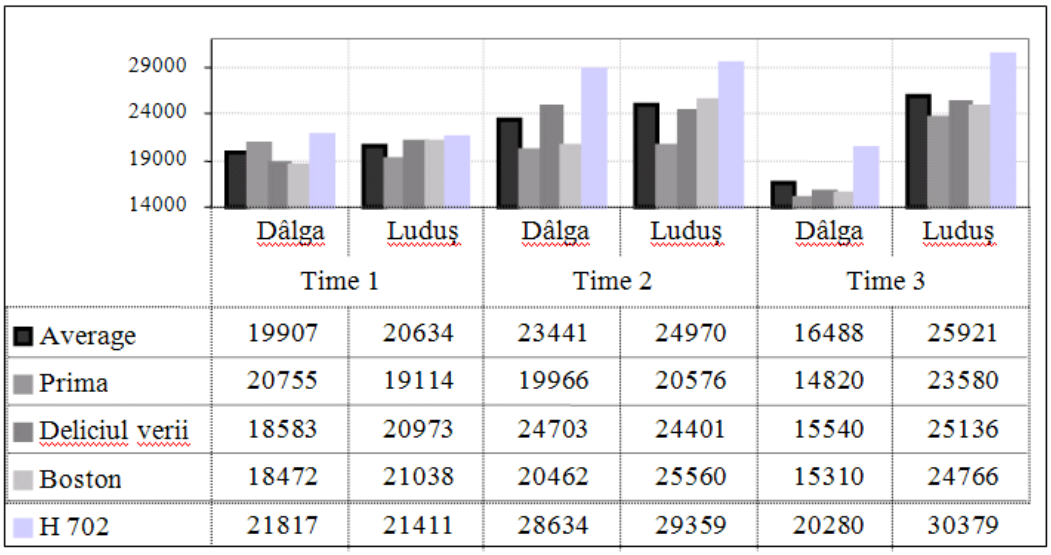

Figure 3. The influence of sowing time on the average weight – Dâlga and Luduş – 2011

Conclusions

Time of sowing had influence on production and production elements to all sweet corn hybrids in both locations (Dâlga and Luduş).
Planting dates also influenced the average ear weight values.
Number of ears per plant ranged from 1.0 to 1.3 for the two locations.
The data presented in the results shows that there is a direct and inverse relationship between number of ears per plant and size of ears.
Hybrid 702, the latest one, presented higher production than other hybrids, making positive significant to very significant differences depending on planting time and location.
Although Romanian hybrids have been exceeded by foreign hybrids on average ear size and the percentage of ears without sheets, because of the ability to form a larger number of ears per plant, finally they realize good level of production.

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AGROSILVOPASTORAL SYSTEM AND FOOD SECURITY IN THE CONTEXT OF GLOBAL WARMING

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Abstract. In the paper is presented a possible prediction of medium temperature increasing with 3^0C up to 2070 year, when over 68% of Romanian territory will be affected by desertification and aridity, with major consequence of bioclimatic and soil changes. These changes will influence the grassland and animal productivity from mountainous zones. The indigenous agricultural system named grove (trees + grassland) or extensive orchard (fruit trees + grassland or agricultural crops) should be more studied by agronomy and forestry specialist for extending on large surfaces like an efficient solution for limiting negative effects of global warming on food security. With the wooded screens of forestation and irrigations, the silvopastoral system is a complementary solution to prevent the desertification and aridity effects on crop and animal productivity.

Key words: climatic prediction, agrosilvopastoral system, grassland productivity

Introduction

The latest projections of climate evolution on earth, general warming due to human activities (deforestation, industrialization, transport, etc.), with increasing carbon dioxide emissions, melting ice caps and mountain glaciers, sea levels rise, flooding, aridity and desertification, increasing thunderstorms processes (hurricanes, typhoons, tornadoes, cyclones, etc.) will have a major impact on all humanity with the worst unforeseeable consequences [1, 2].

Forecasts of global warming will affect the country's pastoral area. Increasing the air average temperature of 3^0C, which is forecast in the years 2070, will lead to aridity and more accentuated desertification of plains and hills with major negative implications on crop production and livestock produced on natural grasslands.

One of the most effective measures to improve the negative impact of desertification and aridity factors with forestry plantations and irrigation is agrosilvopastoral system promoting, in which all components: grass, animal, wood, habitat, biodiversity are in ecological and economically optimal balance.

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The agrosilvopastoral system is specifically in Mediterranean countries with arid climate, known as the "dehesa" and "montado" in Spain and Portugal [6, 9] and in the northwestern U.S. state of Oregon, called "agroforestry" [10].

In our country, in some areas, have been practiced more combinations of agriculture with woody vegetation such as: pasture - trees, meadows - fruit trees, arable crops - fruit trees or wild trees. The combination of pasture - isolated trees is known to us as the "grove" due to the excluded trees from clearing forest or by planting new ones to provide shade for animals.

The planting wood vegetation in existing grassland like wooden Iberian model "Dehesa", adapted to our conditions, known as "grove" or "glade", can substantially diminishes the negative effects of aridity and desertification that will occur in the future [7].

Woody plant species have the advantage they prospect a larger volume of the ground, stopping landslides, reduce erosion of soil, reduce the amplitude of diurnal air and soil temperatures, protects the grass plants and animals of sunburn and dehydration, wind, heavy rain, retain snow that melts slower, extra produce timber and firewood, fruits and fodder, provide a habitat for many species of birds, which in turn consume insects and many other advantages from which improvement of biodiversity and landscape beautification.

Pastoral lands in our country, especially communal pastures are almost no shade for grazing animal, that cause the cow milk production may decrease by 20-40% during periods of strong sunburn. Planting of trees for shade, resistant to animal hoof and the accumulation of excess manure in animal rest areas, would fully solve this problem. Besides the assortment of woody species adapted to these special stationary area conditions is necessary to apply individual protection measures in the early years of growing the young trees until they resist to pressure from grazing animals. After this critical period the plantation may last decades, even centuries, such as some species of oak in our country.

These technologies must be applied as soon as possible so that the future plantation of trees and fruit trees on the grassland shall be well established and developed to exercise their protective influence on the sward and animals, before emphasizing the perspective of the aridity and desertification phenomena.

To achieve these objectives, complex interdisciplinary research is needed on some older agrosilvopastoral systems existing on form of woody vegetation (groves, selvedges, orchards, etc.), in combination with herbaceous vegetation of permanent pastures used by animal grazing or meadow regime.

The results of this research will be the basis of future solutions for “groves” action on regions and bioclimatic altitudinal belts of all grasslands from our country as a

main solution to stop the desertification and aridity effects which will expand more in the near future.

Implementation and expansion of this combined agriculture and forestry system, in addition to the diminishing and balancing role of the extreme weather factors will certainly bring economic and social benefits by increasing the grassland and animals productivity, plus additional the utilization of woody vegetation that is difficult to purchase in the plains and hills. Agrosilvopastoral system contributes to soil erosion and landslide protection on the slopes, increasing the potential for carbon fixation per unit area and not least the beauty and attractiveness of existing landscapes.

2. Climate change forecasts

2.1. Climate change and its consequences in Romania

From the data base WMO (World Meteorological Organization) in Geneva, the average temperature has risen between 1901 to 2000 with 0.6^0C that is very much what. For Romania, as INMH -Bucharest, this increase is 0.3^0C higher in southern and eastern regions (0.8^0C) and lower in intra-region (0.1^0C). Warming is more pronounced after 1961 and especially after 2000 (2003, 2005) when the frequency of tropical days (maximum daily > 30^0C) increased alarmingly long and winter days (maximum daily <0^0C) decreased substantially. As a result, several areas of our country are at high risk of drought and desertification,particulary where the annual average temperature is above 10 ^{0}C, the amount of annual rainfall is below 350-550 mm; rainfall from April to October are under 200 - 350 mm and soil water reserves, at 0 -100 cm, on March 31 is less than 950 -1500 mc/ha.

According to the United Nations Convention to Combat Desertification (UNCDD) the aridity index (annual amount of precipitation / potential evapo-transpiration - ETP) for the arid zones and deserts is 0.05 and 0.65 for dry sub-humid areas, the limit above which a territory is considered to be close to normal. According to this ETP agreement for steppe and silvo steppe is 400-900 mm and 300 mm water in mountain zone.

In the fourth report (2007 year) of the International Committee on Climate Change (IPCC) for the period 2020-2030 compared to 2000 in an optimistic variant is expected to increase average global temperature by 0.5^0C and a pessimistic variant by 1.5^0C. During the period 2030-2100 the increase in the two variants is between 2.0^0C and 5.0^0C, what is very much. If we would take the year 2070 an increase of only 3^0C above current levels, then 68% of Romanian territory situated below 500 m altitude will be subject of aridity and desertification process, respectively more than double the current mountain area (Table 1).

Table 1) Percentage altitudinal distribution of the relief of Romanian territory **(**after GEOGRAFIA ROMÂNIEI vol.I, 1983**)**

Altitude (m)	***% of Romanian territory (237,5 thousand km^2)***	***From which:***		
		Mountain	***Hill***	***Plain***
over 2000	1	3		
1500 - 2000	3	7		
1000 - 1500	6	19		
700 - 1000	12	36	3	
500 - 700	10	16	12	
300 - 500	18	12	38	1
200 - 500	12	7	24	5
100 - 200	18		18	35
0 - 100	20		5	59
over 500 m	**32**	**81**	**15**	
under 500 m*)	**68**	**19**	**85**	**100**

*) the affected territory of aridity and desertification process in situation when the medium temperature increase is 3^0C forecast until to 2070 year

By increasing the average air temperature of 3^0C in Romania is expected that Dobrogea, south of Moldova, western Transylvania, Banat, south Oltenia and much of southern Romanian Plain, that over 30% of the country area will be affected by a process of desertification and the remaining surface approx 38% by a sharp aridity process, which will include further all our plains, up to 85% of the hills and almost 20% of mountains area with the lower altitudes.

2.2. Forecast changes in bioclimatic

Predicted climate change will have a major impact on the current redistribution of vegetation on zones and altitudinal levels which in turn will influence habitats and economic performances. According to forecasts for the years 2070 an increase of 3^0C of average air temperature in the mountain area, after current altitude gradients (-0.5^0C / 100 m alt.) [4], an increase of the current distribution of primary vegetation with 600 m is estimated.

For our country mountains these bioclimatic changes on 2070 year is presented in Table 2.

From these data it results that in the high mountains will disappear the alpine and sub-alpine levels (Pinus mugo), being replaced by spruce and beech forest level. Also the steppe zone will replace the upper levels of oak forests and silvosteppe will replace the lower levels of beech forests. These major changes in the altitude distribution of woody vegetation in the mountain area will allow a natural decreasing with 40-70% of actual forest area and the dramatic consequences of water balances and rainfall will be expected.

Table 2 Change of bioclimatic and vegetation levels to an increase in average air temperature of 3^0C (forecast year 2070)

Current level (zone)	***Altitude*** *(m)*	***Temperature annual mean (^{0}C)***		***Annual rainfall (mm)***		***Levels (zones) changed after tens years***
		Actual	Year 2070	Actual	Year 2070	
Alpine	2200-2400	-1	2	1500	1250	Spruce
Pinus mug	2000-2200	0	3	1450	1150	Spruce
Pinus mugo	1800-2000	1	4	1350	1050	Spruce + Beech
Spruce	1600-1800	2	5	1250	950	Beech
Spruce	1400-1600	3	6	1150	850	Beech
Spruce + Beech	1200-1400	4	7	1050	800	Oak
Beech	1000-1200	5	8	950	700	Oak
Beech	800-1000	6	9	850	600	Silvosteppe
Beech	600-800	7	10	800	500	Steppe
(Oak) (Silvosteppe) (Steppe)	**GRADIENT for each 100 m alt.**	**-0,5 ^{0}C**	**-0,5 ^{0}C**	**+45 mm**	**+45 mm**	(Subhumid – dry) (Semiarid) (Arid - deserts)

2.3. Prognosis of changes in mountain soil

Climate change will also affect the physic - chemical properties of soil (Table 3). Thus, the thickness of soil over the next 60-70 years will be about the same, taking in account that 1 cm soil is formed in amount 100 years in the temperate zone. Instead of some agrochemical properties are subject to change on a nondescript term until approaching a specific balance imposed by temperature and precipitation projected for the 2070 year.

Soil reaction (pH) and degree of base saturation (V%) will change in corresponding with the altitudinal rise of the level of more active bioclimatic indicators for vegetation [8].

The slower changes of the soil will make the productivity of natural vegetation and crops to be lower, although more favourable conditions of heat will be at higher altitudes in the future.

Table 3) Changing soil conditions to increase the average air temperature with 3^0C (forecast 2070 year)

Actual level (zone)	*Altitude (m)*	*Soil thickness (cm)*		*Soil layer, A*			
		Actual	*Distant future*	*pH in water*		*V %*	
				Actual	*Nearest future*	*Actual*	*Nearest future*
Alpine	2200- 2400	20	**Slow growth** (about 1 cm per 100 years)	3,6	4,5	6	24
Pinus mugo	2000-2200	35		3,9	4,8	12	30
Jneapăn	1800-2000	50		4,2	5,1	18	36
Spruce	1600-1800	65		4,5	5,4	24	42
Spruce	1400-1600	80		4,8	5,7	30	48
Spruce+ Beech	1200-1400	95		5,1	6,0	36	54
Beech	1000-1200	110		5,4	6,3	42	60
Beech	800-1000	125		5,7	6,6	48	66
Oak	600-800	140		6,0	6,9	54	72
(Oak) (Silvosteppe) (Steppe)	**GRADIENT for each 100 m alt.**	**-7,5mm**		**-0,15**	**-0,15**	**-3%**	**-3%**

3. Components traditional agrosilvopastoral

For centuries in our country has been practiced more combined culture system between woody vegetation (trees and fruit trees) and the grasses of pasture or arable crops. Next there are mentioned the most important of them, particularly with major role in the development of subsistence agriculture.

3.1. Communal pastures with trees

Given the characteristics of the forest microclimate more balanced than the one extreme of the open field, from a long time ago in our country have done work of thinning the existing forests in order to install swards for animal feeding, the action called "groves".

In areas where the wood vegetation was cleared were planted solitary trees, tree clusters or/and tree alignments for animals sunburn protection simultaneously with wood making necessary for household.

The action of "setting" of seedlings in grassland can be named grove, as the establishment of forest belts in arable land is called wooded screen [3].

Thus, as a results of tree planting process on grassland there are the known “groves” or “glades”, where live in good harmony woody vegetation, swards and

animals. Up to collectivization of agriculture the majority communal pastures were planted with different species of trees for shade to animals.

Species of wild trees and fruit trees used primarily for shade, were chosen according to the stationary conditions in willows and poplars in meadow, acacias, oak, ash, wild hair, walnut, etc. in the plains and hills, beech, fir, spruce and other species in the mountain zone. Testify and now the secular oaks groves from Cristian, Harman, Daisoara, Fişer–BV, Reghin-MS, Ţigăneşti-BC, Remetea-BH, Poşmuş-BN, Dioşti-DJ and others. Among these is distinguished the secular oak from Poşmuş - Şieu that in 2006 turned 600 years old, being perhaps the oldest tree in Romania [5].

Unfortunately, many of these secular trees were burned, cleared, vandalized, without putting anything in place, animals on pasture feel the full effects of heatstroke and sunburns during the summer period, with the decrease of milk and meat production.

3.2. Fruit trees-meadow and pasture system

In some areas of hills and depressions there are grassed orchard with fruit trees used as hay making or grazing animals. Most widespread species is plum, followed by apple, pear, walnut, etc., cultivated extensively with unbalanced production from year to year. So it was created a jointhousehold orchard-meadow that has proven both to produce fruit with minimal intervention and used as pasture or meadow in animal feeding. Also the animals benefits of more shade and supplementary feed because of fruits attacked by pests and diseases that have fallen from trees.

In orchards located on abrupt slopes from hill area the fruit trees also have an anti-erosion role and stabilize land against landslides. A special case is the alignment of mulberry trees along the roads where geese on pasture supplement their food with mulberry fruits on July-August months when the grass is low rate.

Many of these systems of grassed orchard are in abandon, only in a few places the are thus the orchards maintained in households from the counties of Subcarpathian area Vrancea, Buzau, Prahova, Arges, Dambovitaand Valcea.

3.3. Terrace with arable, slope with meadow and the row of trees system

One of the most interesting complex systems for improving the sloping agricultural land consists in terracing for arable crops in the grass embankment used as meadow and a row of trees on the top edge of the slope, especially specific in south-western of Transylvania. For hundreds of years this system has provided grain crops, hay for livestock farming fruits for direct consumption and

preserving in terms of protection against surface and depth erosion of the soil on greater slopes. Unfortunately, this system is now largely abandoned, being invaded by woody vegetation and unvalued grasses.

Returning to the old system of effective utilization of arable land-meadow–fruit trees with modern means of mechanization, organic fertilization from livestock farm and other measures in addition to practice of organic farming and tourism, would have great future in these disadvantaged areas with major handicaps.

3.4. Protection of traditional systems

In our country it is found that there were and still are in some form, agrosilvopastoral different systems that need to be better known and reviewed in the future.

Their studies were marginalized, agronomists considering that is the job of foresters, foresters themselves dealing with complete forest, less than isolated trees on pasture, etc.

While Mediterranean countries heavily affected by heat and excessive dry periods, foresters and agronomists have already taken concrete action with awareness and generalization of traditional systems as Spanish Dehesa. In our country, these systems have not been taken into account before to extend them to prevent negative effects of global climate warming.

Therefore, it is considered necessary an inventory of all our agrosilvopastoral systems, by mixed teams, agronomists and foresters, followed by study of their functionality as a solution of protecting the sward, arable crops, grazing animals, trees, fruit trees, etc., economic source of fodder, livestock products, cereals, fruit, wood, landscape beauty, and more. After establishing the main functions of agrosilvopastoral systems can go further modernization of maintenance and utilization of these complex resource that can better adapt to future climate change.

Thus the system agrosilvopastoral with afforestation of degraded lands, establishment of forest belts, expansion of irrigation and other means can complete specific measures to combat desertification and aridity that will affect both the pastoral land and livestock.

A complex agrosilvopastoral system can cross more easily a warming climate period than the current system with pasture without trees, simple arable crops and another.

Conclusions

In Romania because of the increasing the average air temperature only with 3^0C, until 2070, according to forecasts, over 30% of the country will be affected by desertification and about 38% of intense aridity, which will encompass all our plains, up to 85% area of hills and almost 20% of the pre mountain and low mountain area;

The forecast of global warming with 3^0C, in our country will create major disturbances in the altitudinal distribution of vegetation belts of the Carpathians, to increase the upper limit of spruce with 600 m, reaching 2400 m altitude, with the gradual disappearance of subalpine (Pinus mugo) and alpine belts. Maximum productivity of forests and natural grasslands currently located at the 1000 – 1200 m by global warming will rise to 1600 – 1800 m altitude;

The possibilities of increasing the production of mountain grassland that will benefit by higher heat and humidity than at present, are seriously diminished by the physical - chemical soil properties that will change much slower than the climate, difficult access conditions, etc. Causes for which will be necessary to develop other related activities such as agro tourism;

The local agrosilvopastoral system is called the grove, on grassland being species of trees, especially oaks and orchards with far-between different fruit species where is growing grass that is used by grazing or mowing. More detailed studies on these mixed production systems, their extending to areas already affected by aridity and their protection where there still are, are necessary to perform as soon as possible by teams of specialists in agriculture and forestry;

In the future, are necessary to carry out the complex studies and long-term research, located in different areas affected by desertification and aridity, where the main factors to be monitored are climatic, edaphic and vegetation productivity of wood and pasture vegetation, livestock and crops from agrosilvopastoral systems, in order to determine more accurately their evolution over time, data that will be basis of the future development programs of agrosilvopastoral system, as an viable alternative for food security in the context of global climate warming.

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